



Weatherford

**COMPACT PHOTO DENSITY
COMPENSATED NEUTRON
MICRORESISTIVITY LOG**

COMPANY		CIMAREX ENERGY CO.			
WELL		HAMMER 19-5			
FIELD		LETTE SE			
PROVINCE/COUNTY		HASKELL			
COUNTRY/STATE		U.S.A. / KANSAS			
LOCATION		330' FSL & 1320' FEL S2 S2 SE			
SEC	TWP	RGE	Other Services		
19	30S	31W	MA/ME	MFT	
API Number		15-081-22026	MSS	CMI	
Permit Number			MFT		
Permanent Datum GL, Elevation 2848 feet					
Log Measured From KB					Elevations: KB 2857.00 DF 2855.00 GL 2848.00
Drilling Measured From KB					
Date	26-AUG-2013				
Run Number	ONE				
Service Order	3539920				
Depth Driller	5544.00				feet
Depth Logger	5540.00				feet
First Reading	5697.00				feet
Last Reading	4000.00				feet
Casing Driller	1860.00				feet
Casing Logger	1861.00				feet
Bit Size	7.875				inches
Hole Fluid Type	GEL				
Density / Viscosity	9.30	lb/USg	47.00	CP	
PH / Fluid Loss	11.50		8.40	ml/30Min	
Sample Source	FLOW LINE				
Rm @ Measured Temp	1.12 @ 62.0				ohm-m
Rmf @ Measured Temp	0.90 @ 62.0				ohm-m
Rmc @ Measured Temp	1.34 @ 62.0				ohm-m
Source Rmf / Rmc	CALC		CALC		
Rm @ BHT	0.54 @ 128.0				ohm-m
Time Since Circulation	5 HRS				
Max Recorded Temp	128.00		deg F		
Equipment / Base	13244		LIB		
Recorded By	R.HOFFMAN				
Witnessed By	T. KOLODZIEJ				
IOB #	LB 13-234				

BOREHOLE RECORD					Last Edited: 26-AUG-2013 07:30
Bit Size inches		Depth From feet		Depth To feet	
7.875		1860.00		5544.00	
CASING RECORD					
Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft	
SURFACE	8.625	0.00	1860.00	24.00	

REMARKS
- SOFTWARE ISSUE: WLS 13.05.9583.
- RUN ONE: MCG, MML, MDN, MPD, MIE, MFE, MAI RAN IN COMBINATION. - HARDWARE: DUAL BOWSPRING USED ON MDN. TWO 0.5 INCH STANDOFFS USED ON MSS. CENTRALIZER BOWSPRING ON MIM. STANDOFF USED ON MIE.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- BOREHOLE RUGOSITY, TIGHT PULLS, AND WASHOUTS WILL AFFECT DATA QUALITY.
- ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING: 1362 CU.FT.
- ANNULAR HOLE VOLUME WITH 5.5 INCH PRODUCTION CASING FROM TD 4000 FEET: 275 CU.FT.

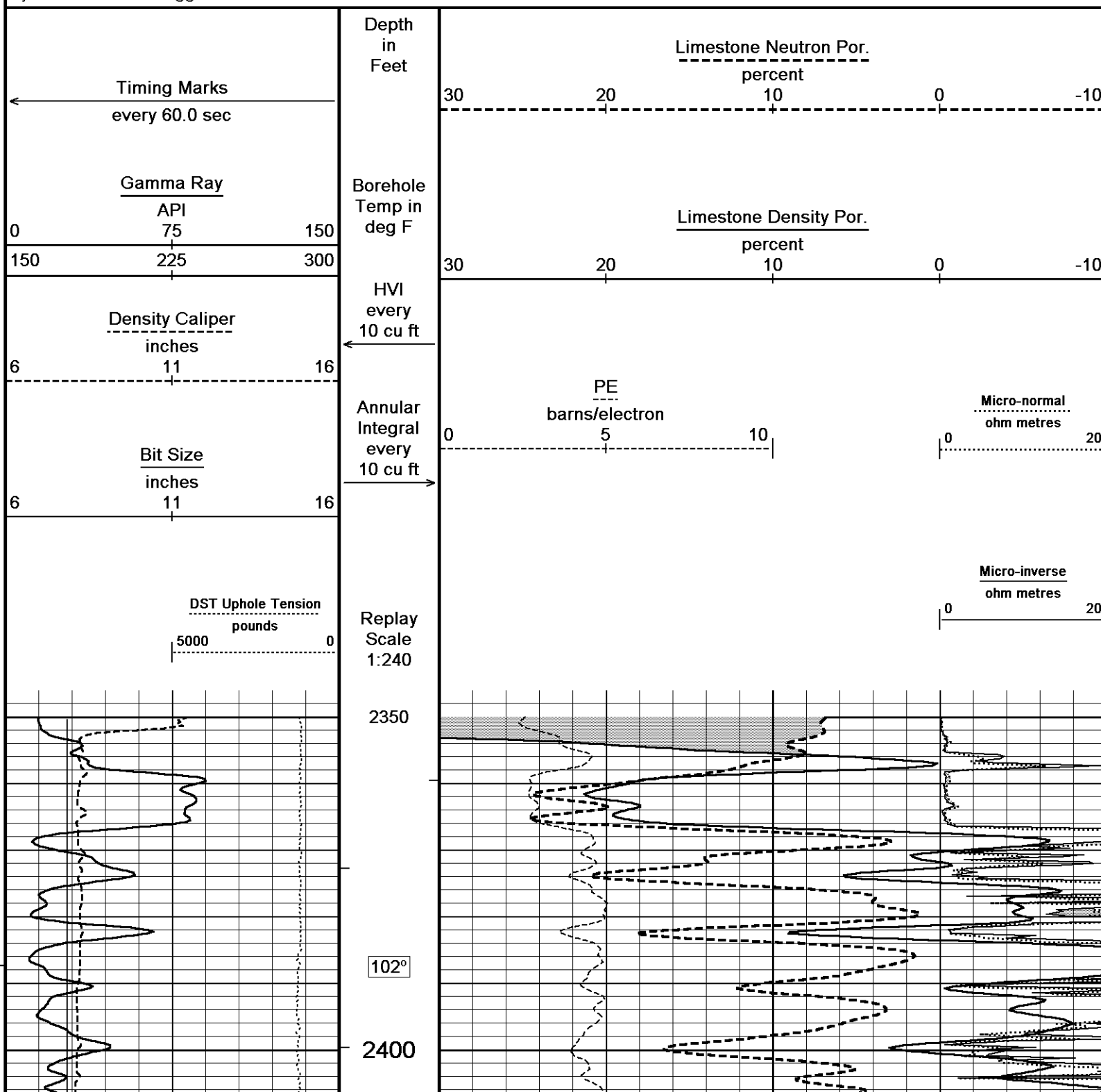
- OPERATOR: C. RAMIREZ.

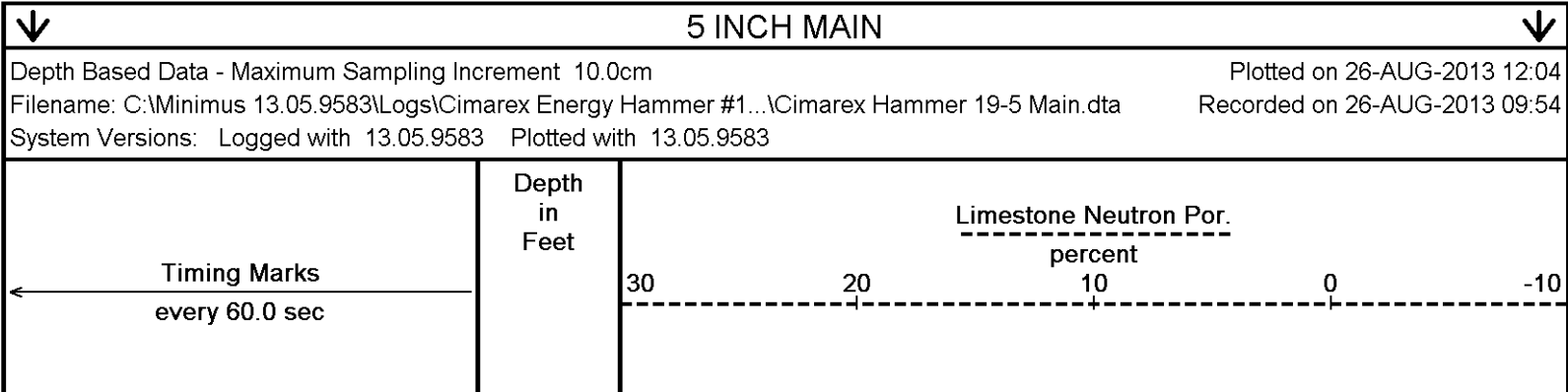
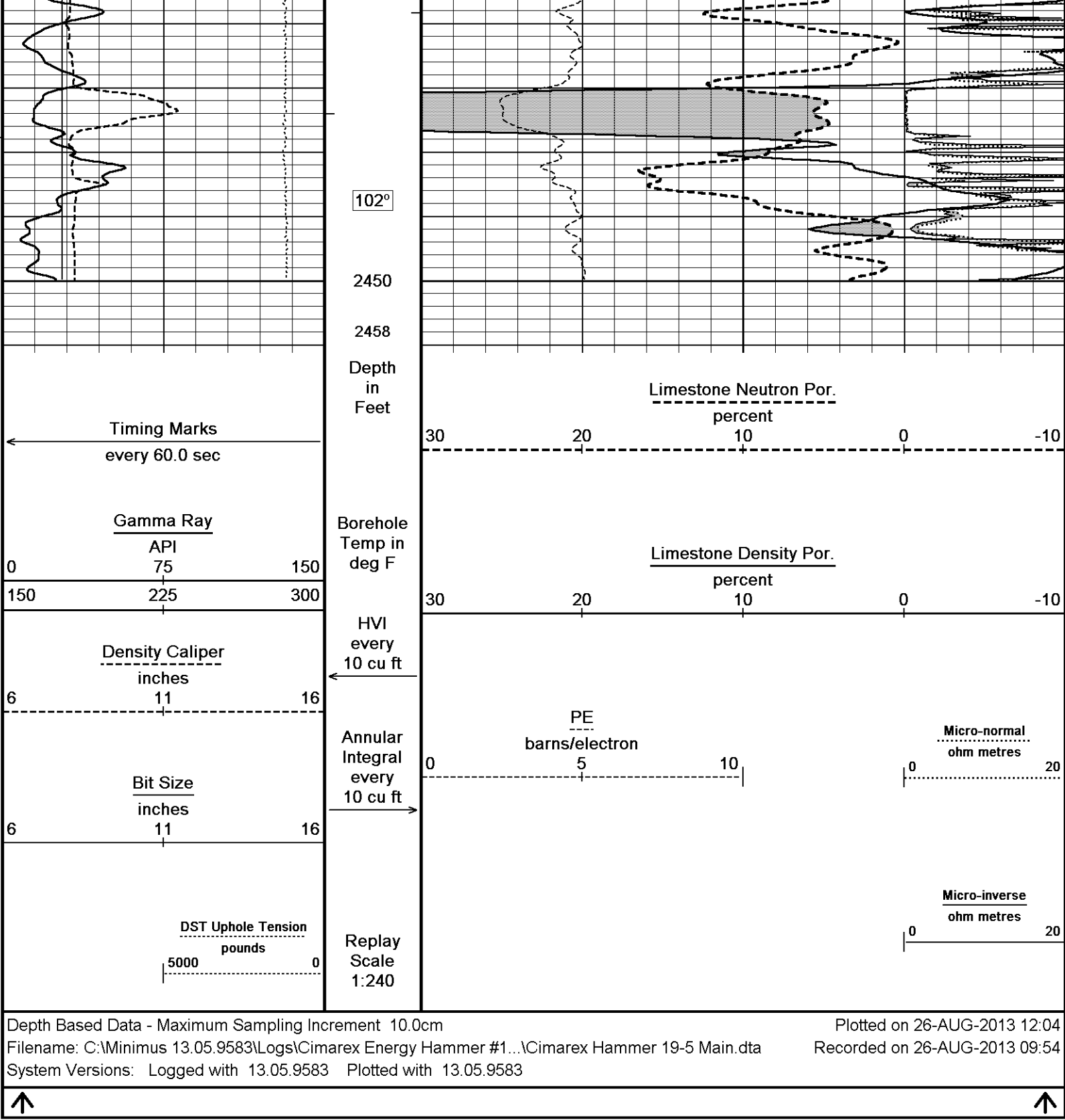
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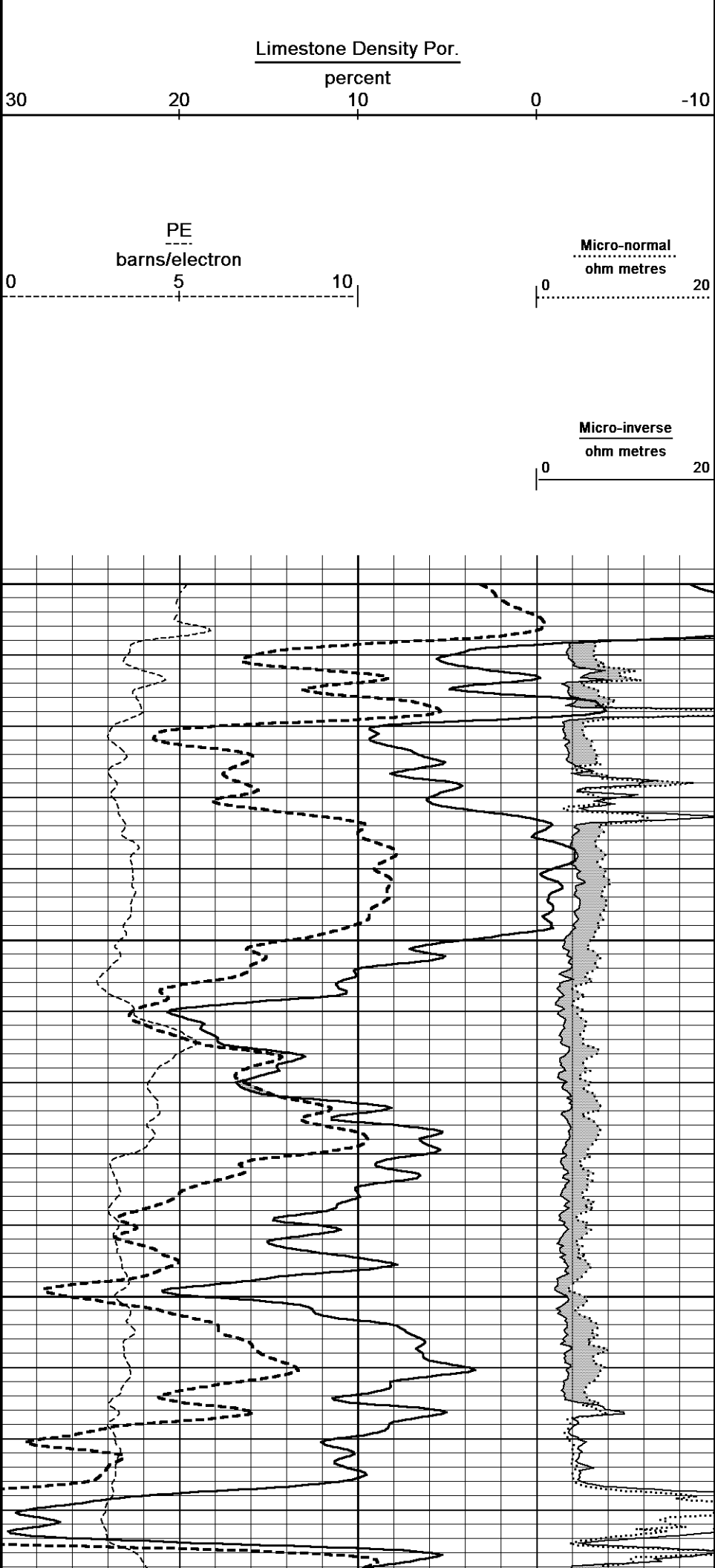
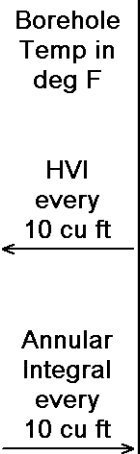
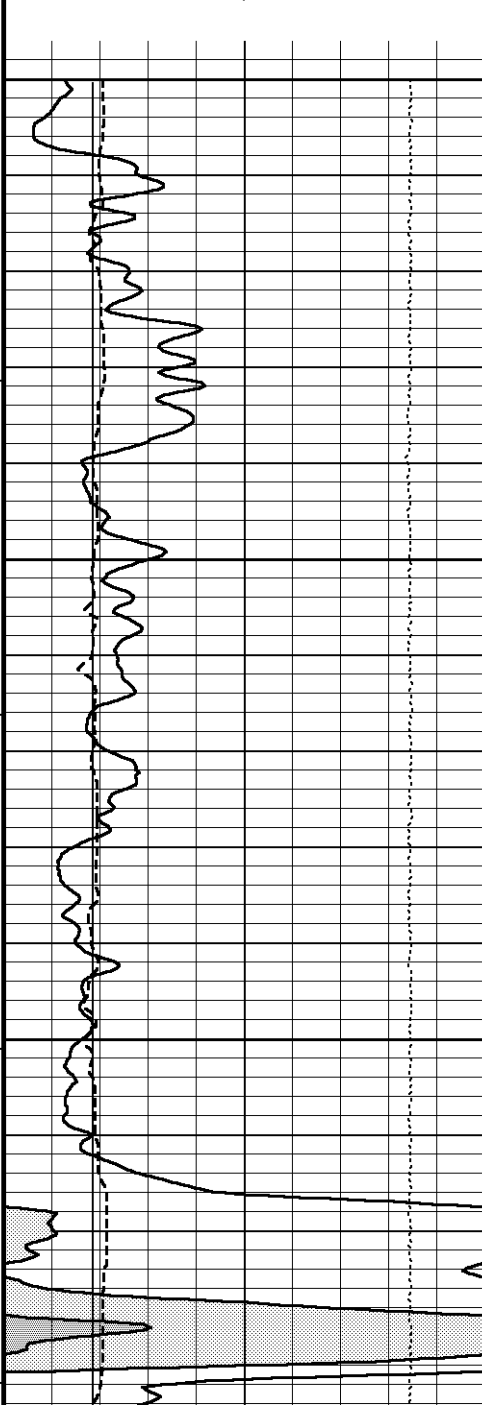
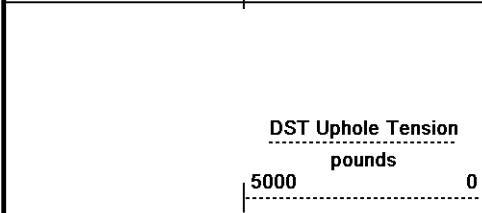
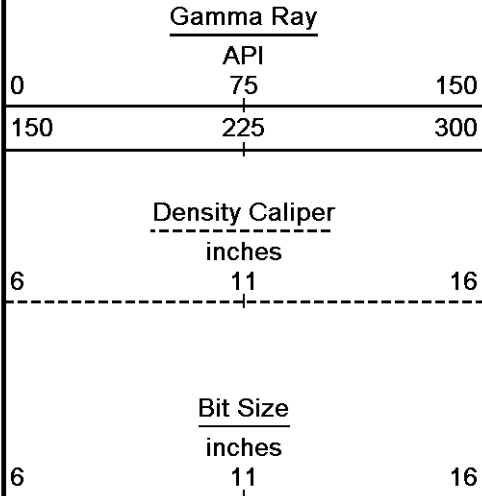
Depth Based Data - Maximum Sampling Increment 10.0cm
 Plotted on 26-AUG-2013 12:04

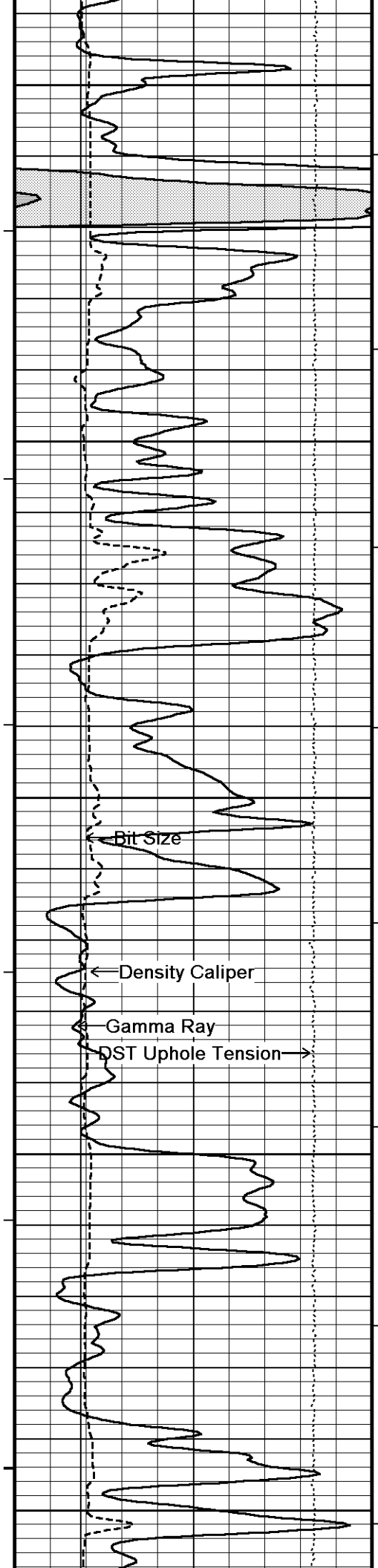
Filename: C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #1...\Cimarex Hammer 19-5 Main.dta
 Recorded on 26-AUG-2013 09:54

System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

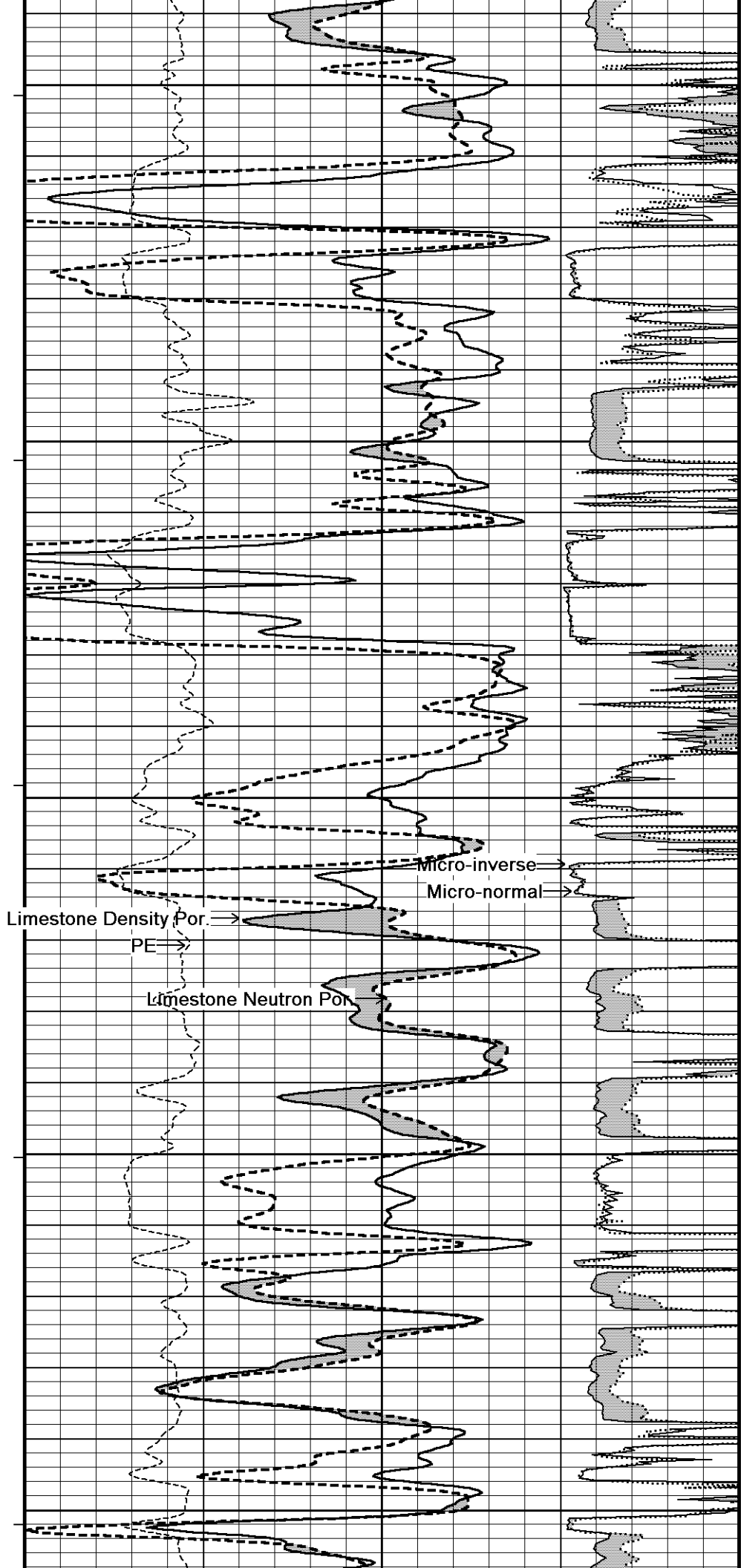


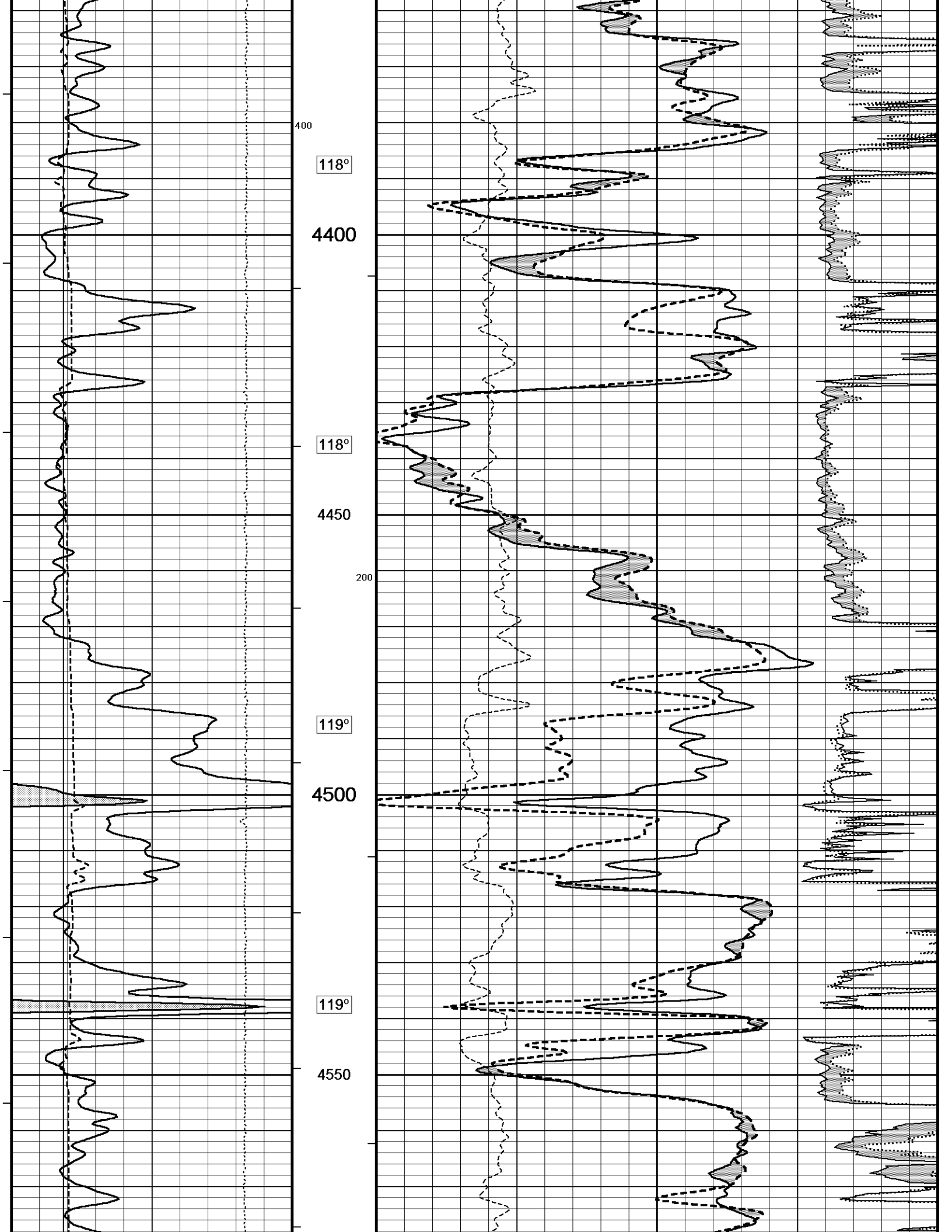


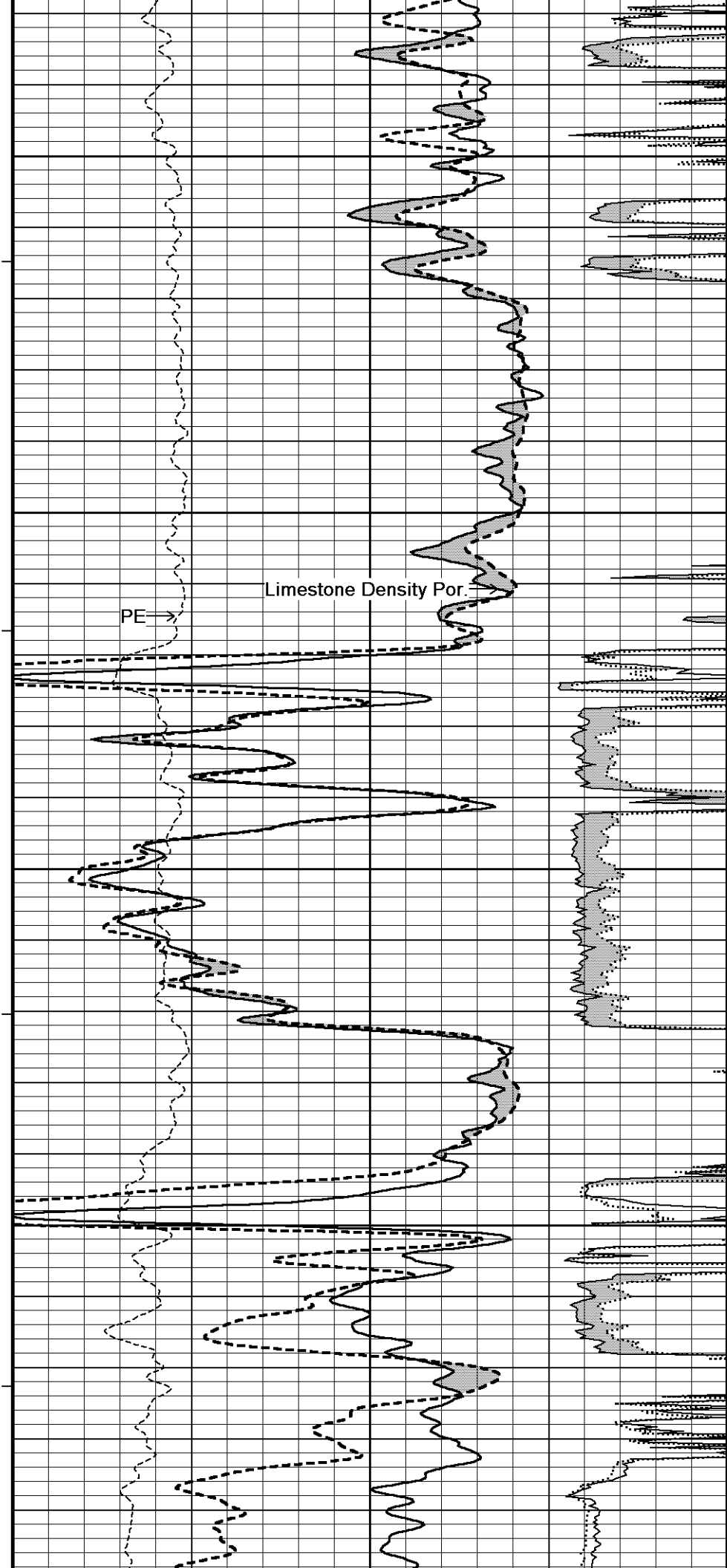
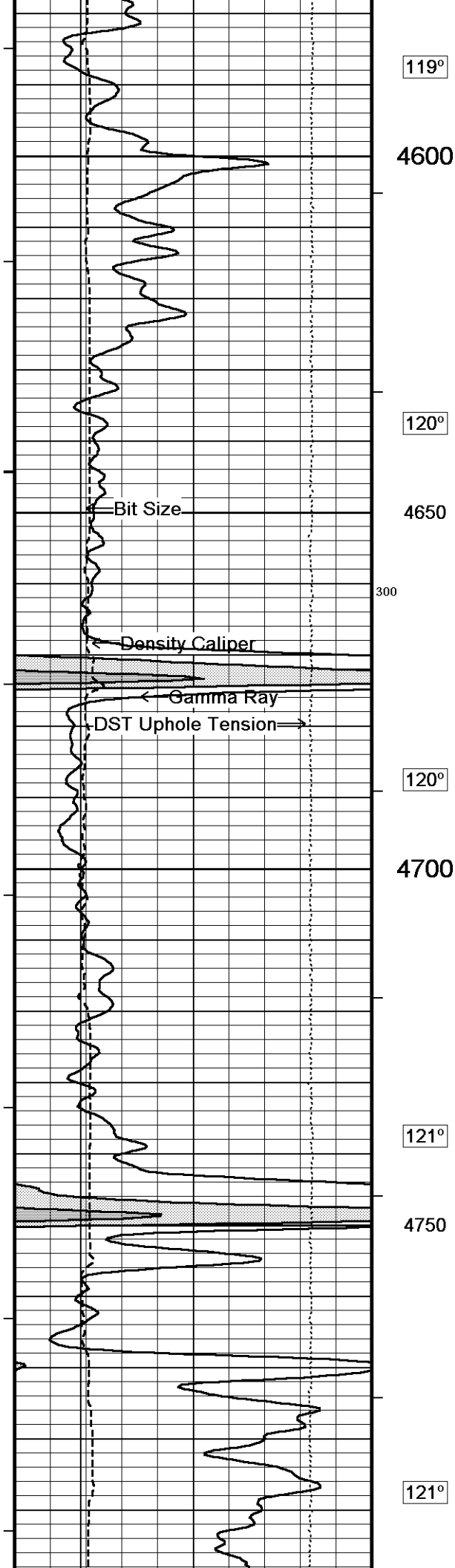


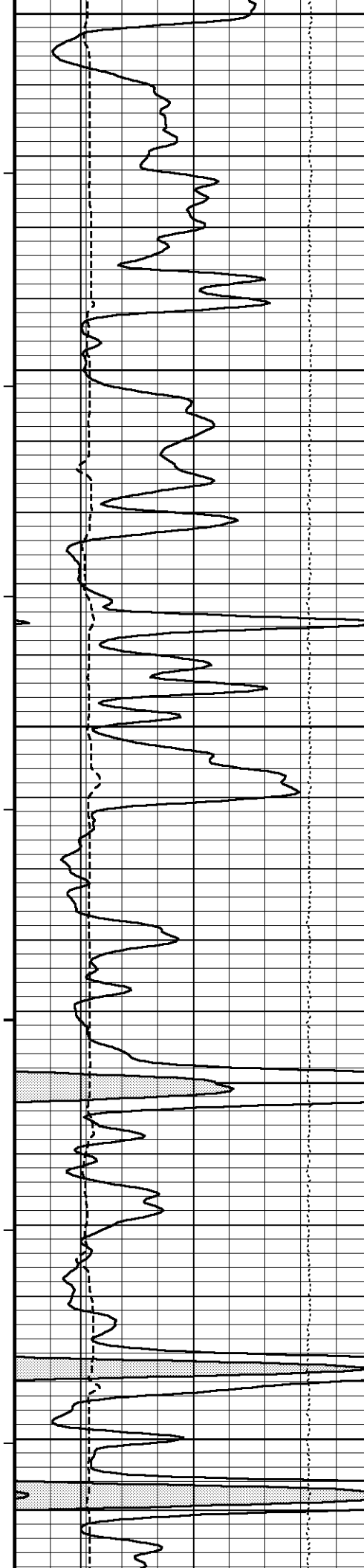


4150
116°
4200
116°
4250
117°
4300
117°
4350

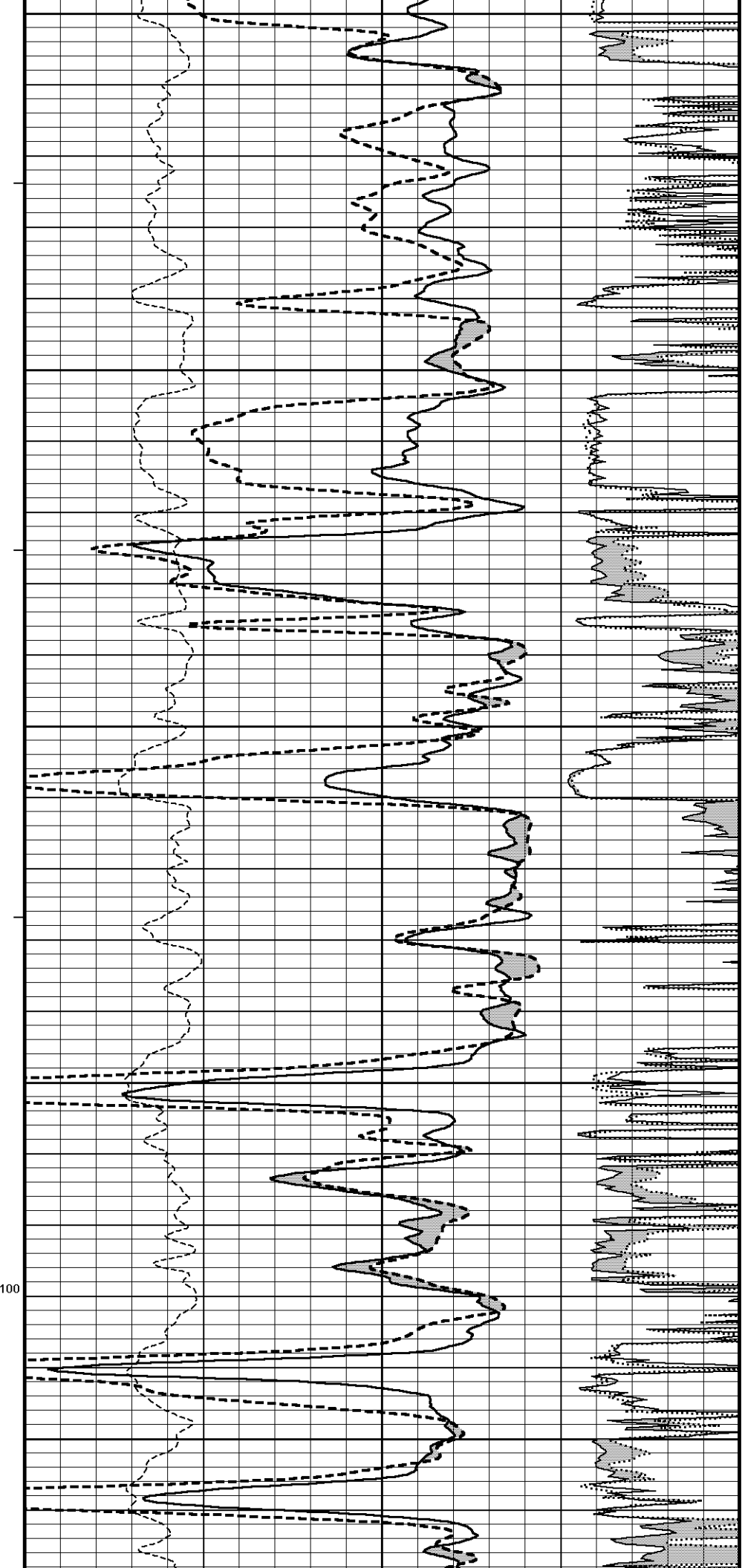


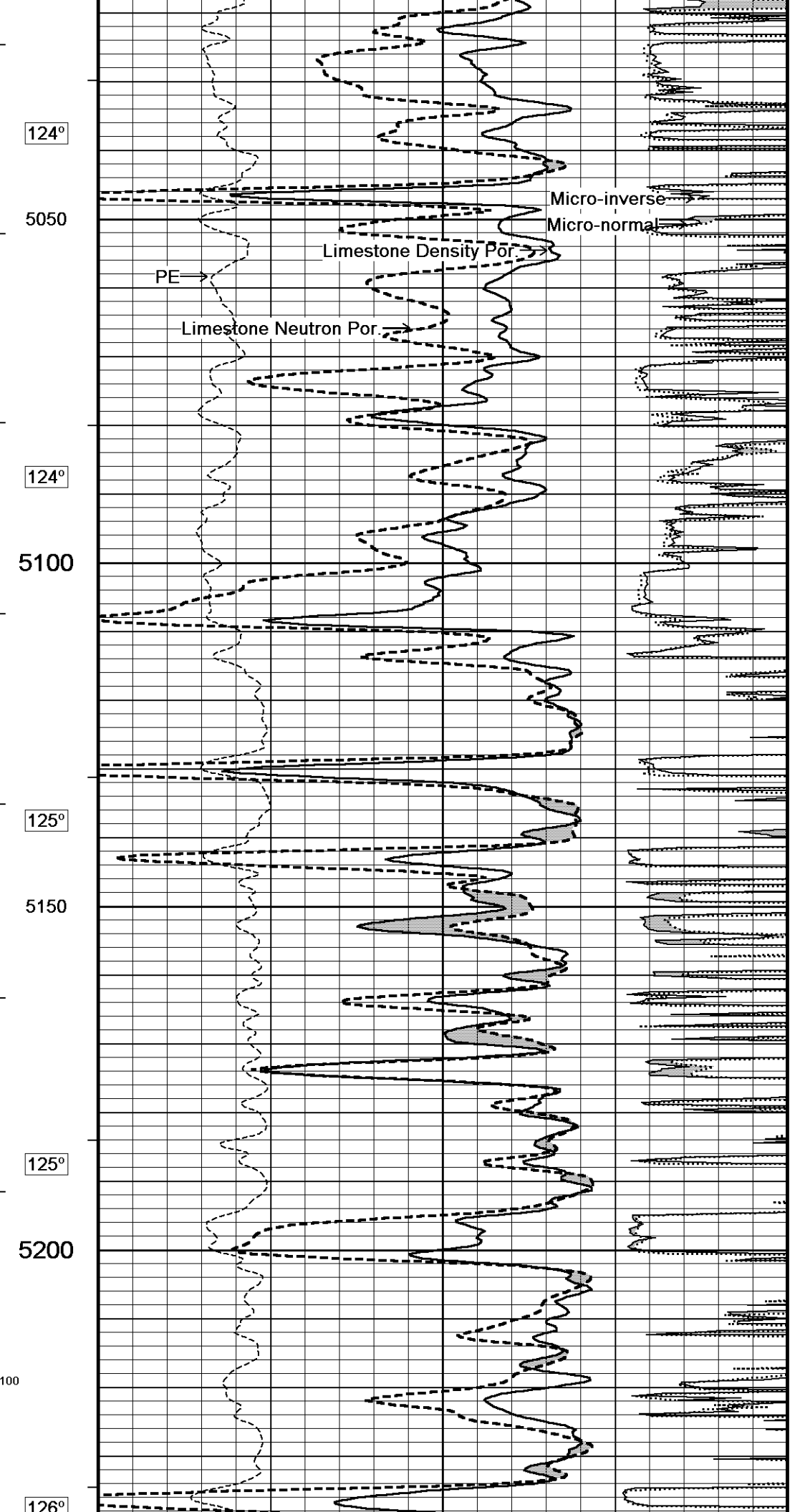
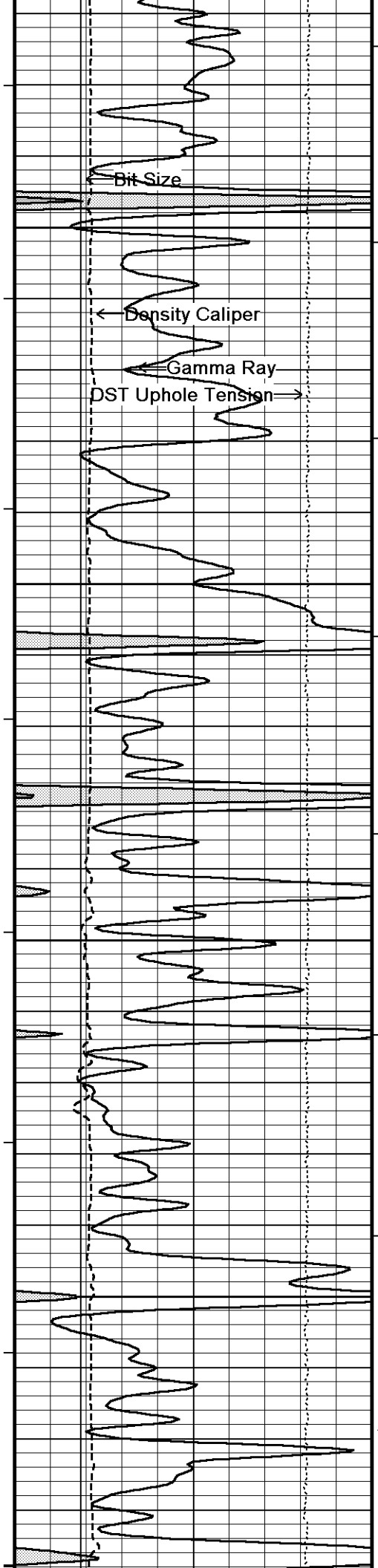


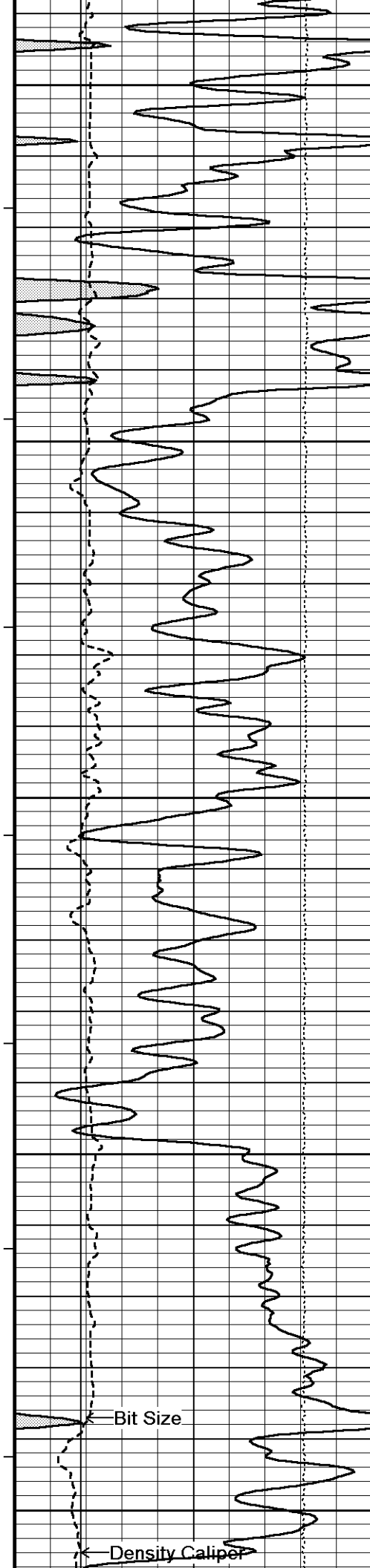




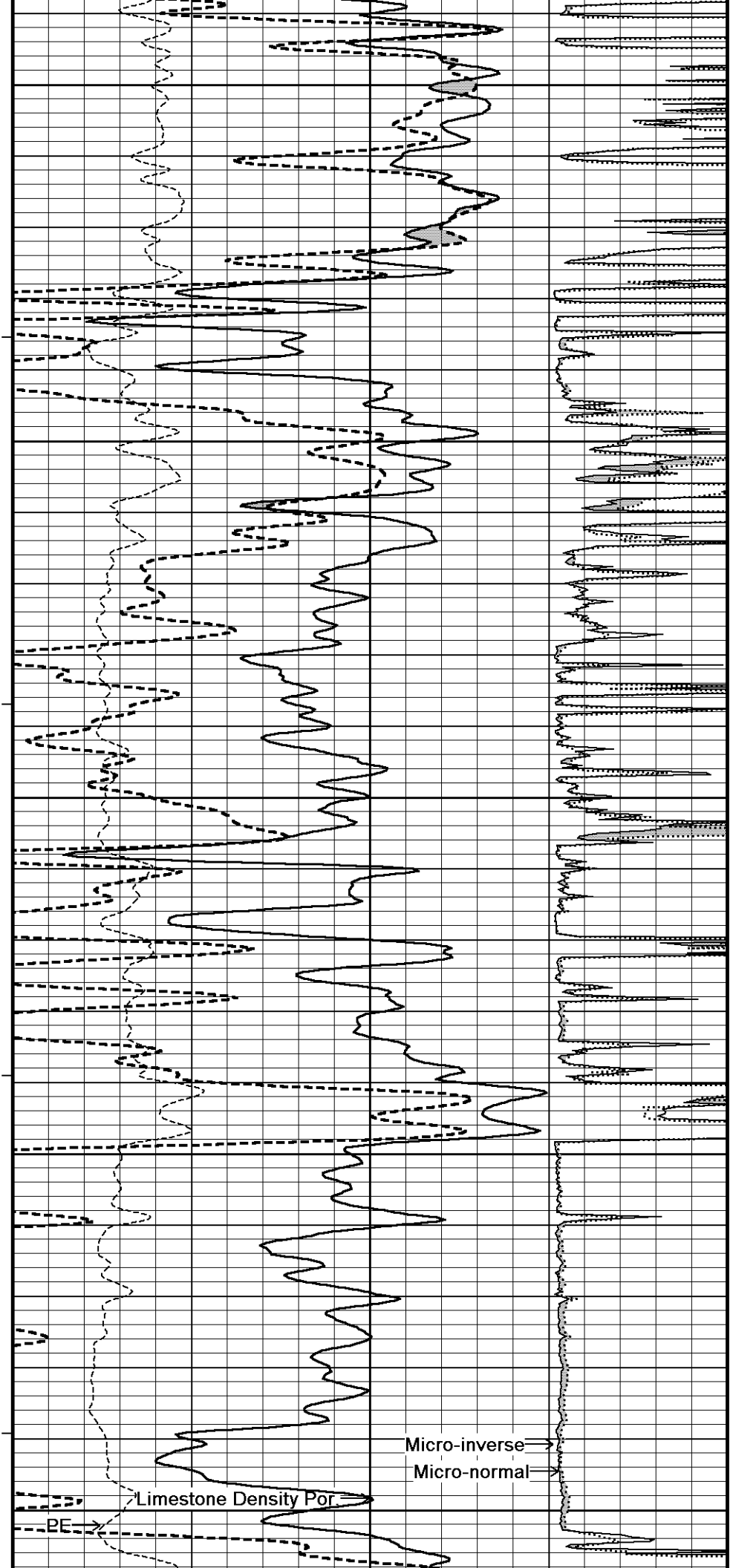
4800
122°
4850
122°
4900
123°
200
4950
100
123°
5000







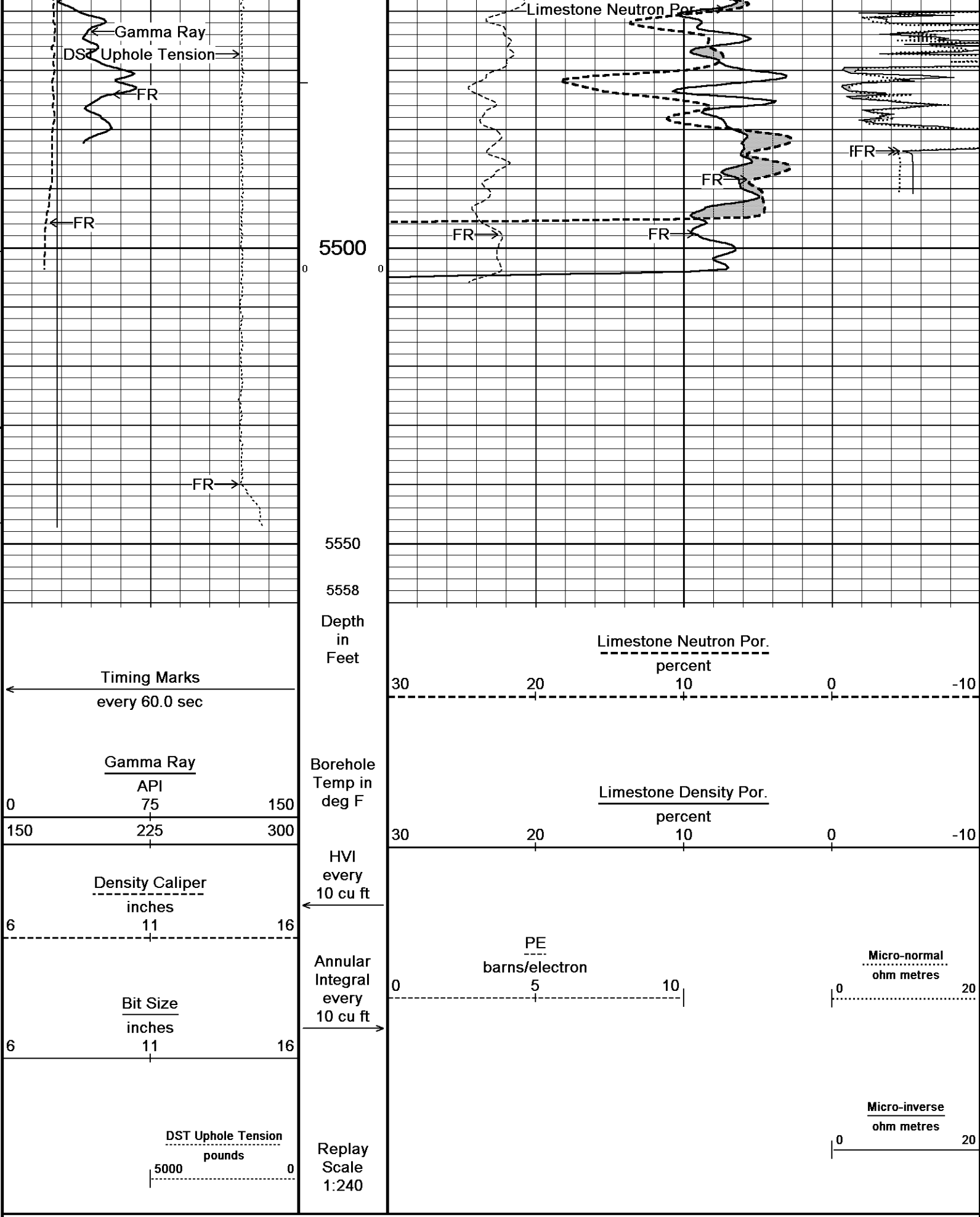
5250
127°
5300
127°
5350
128°
5400
128°
5450

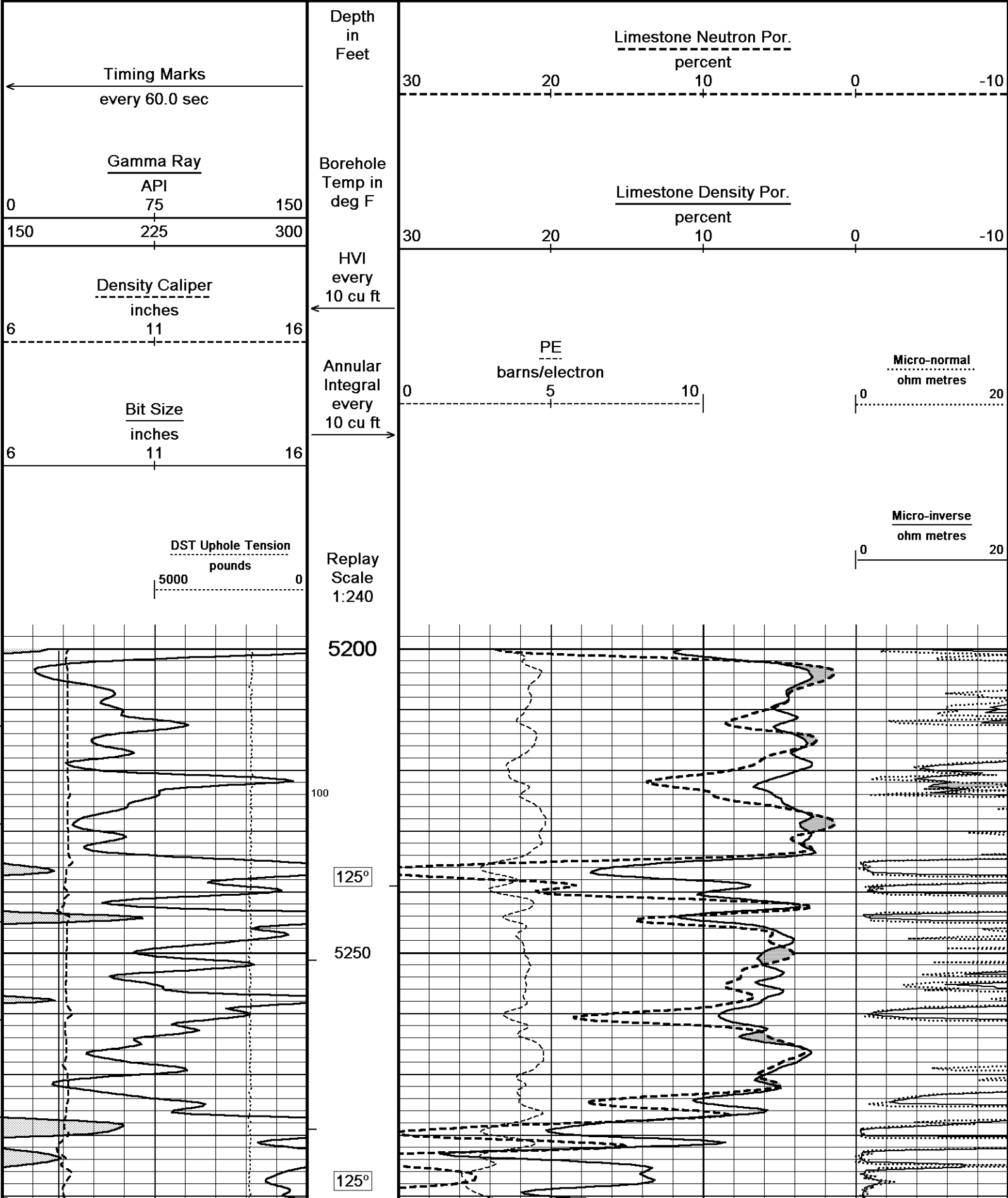


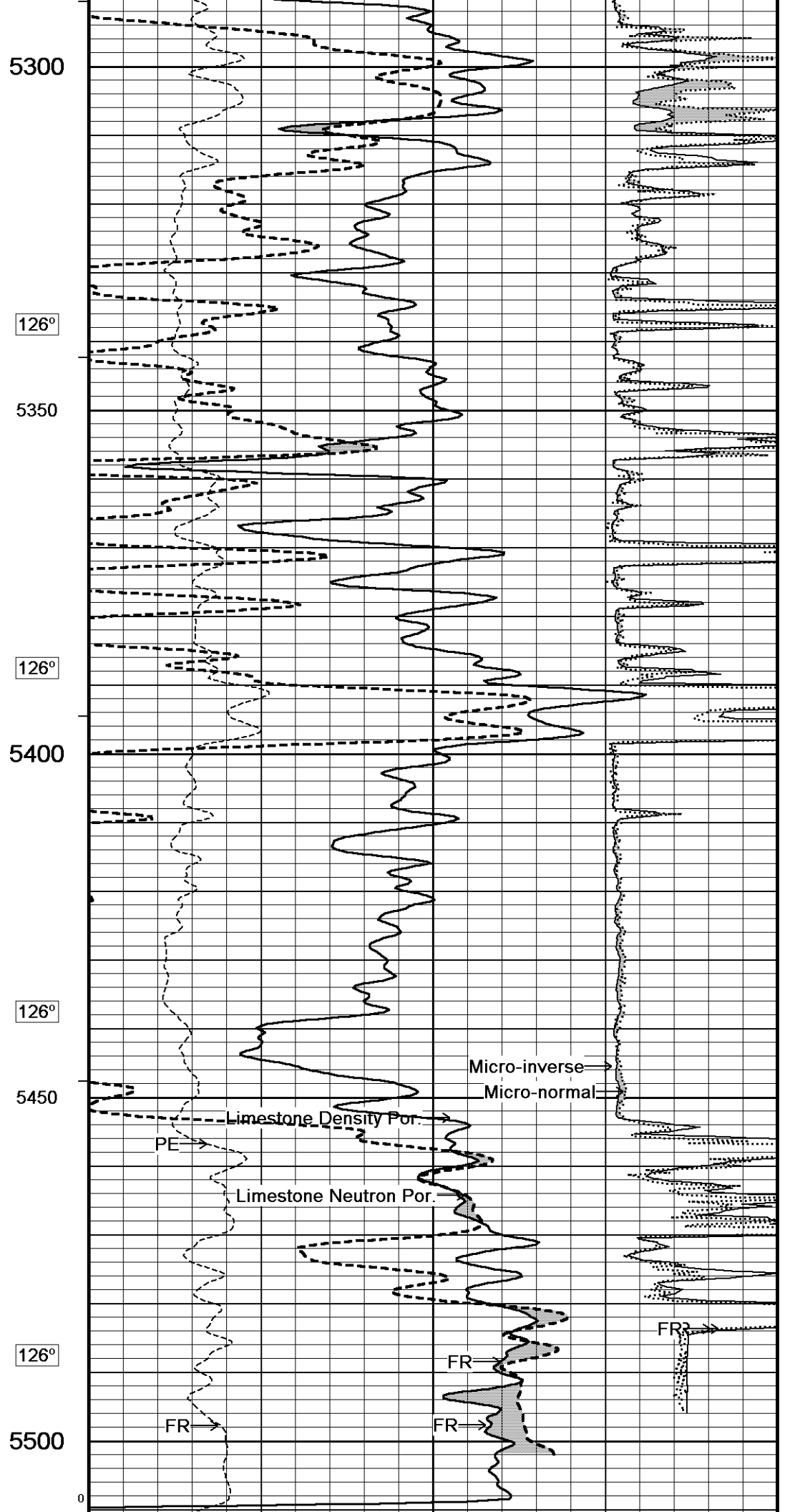
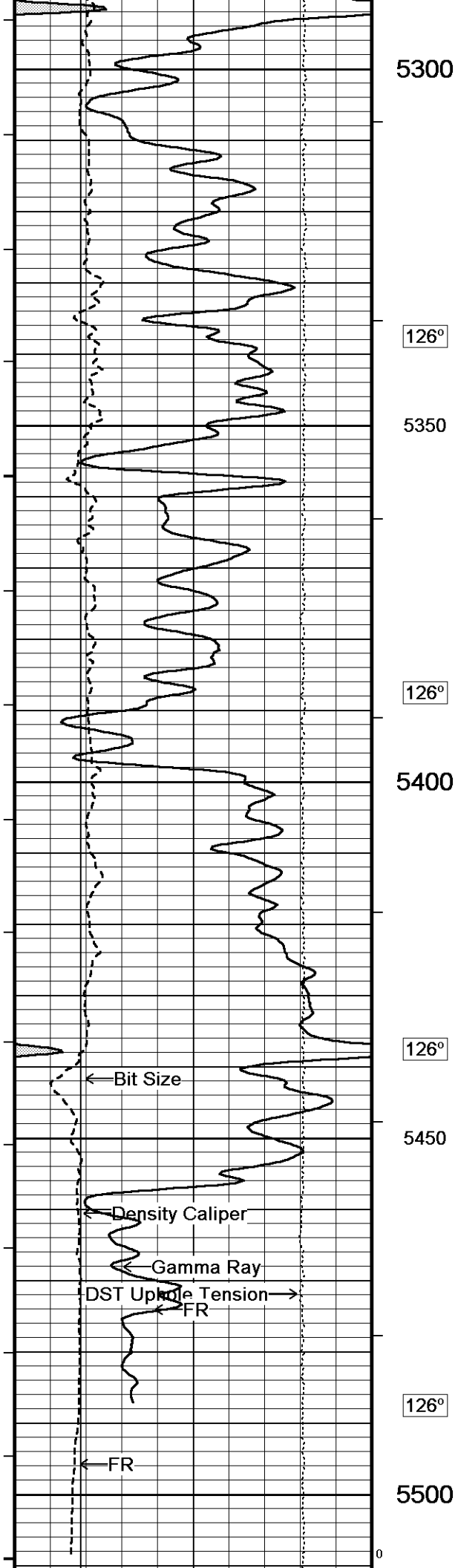
Limestone Density Por

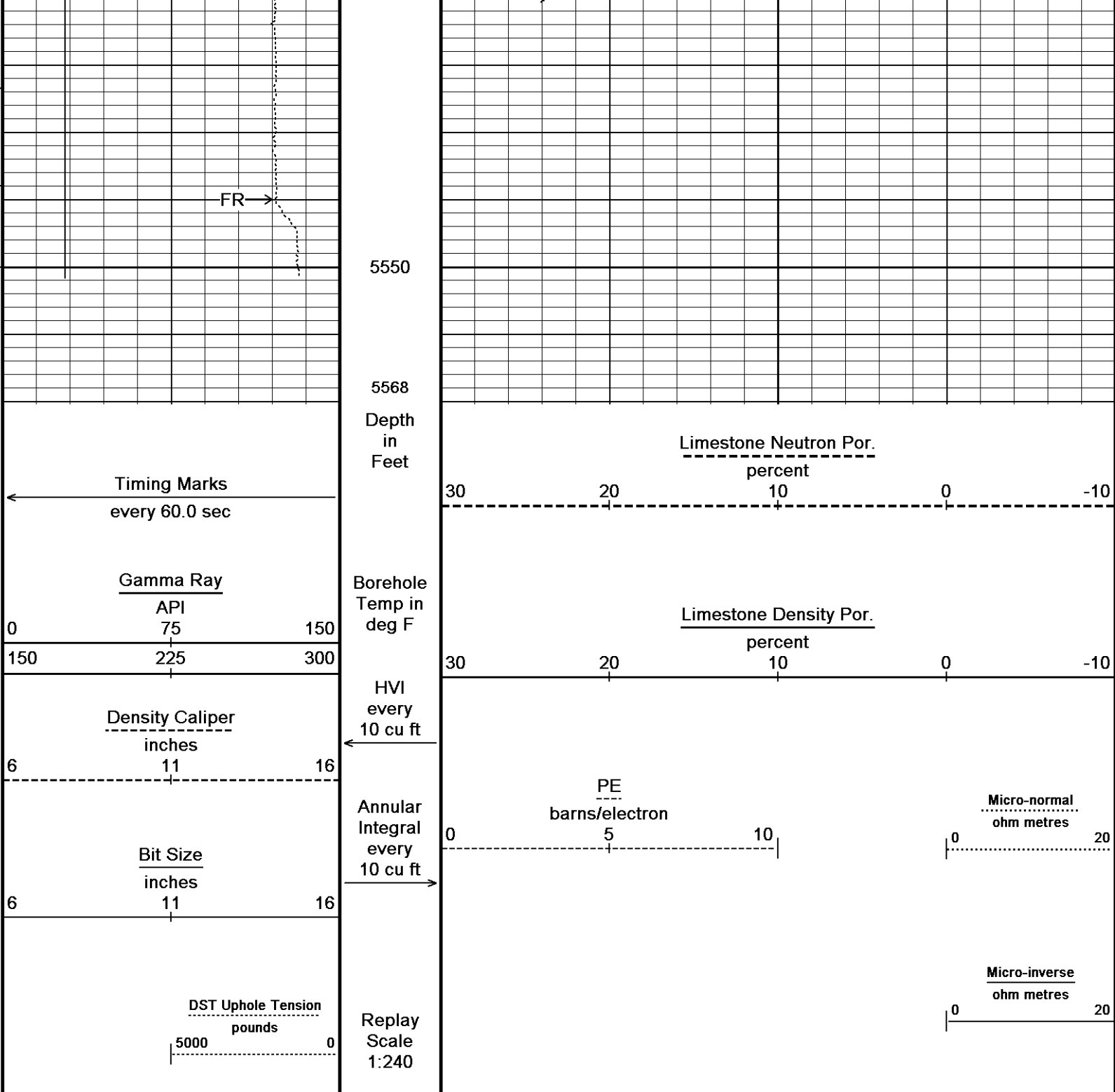
PE

Micro-inverse
Micro-normal





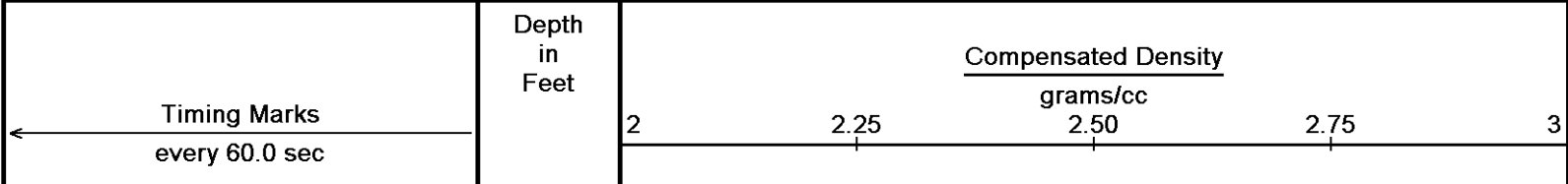


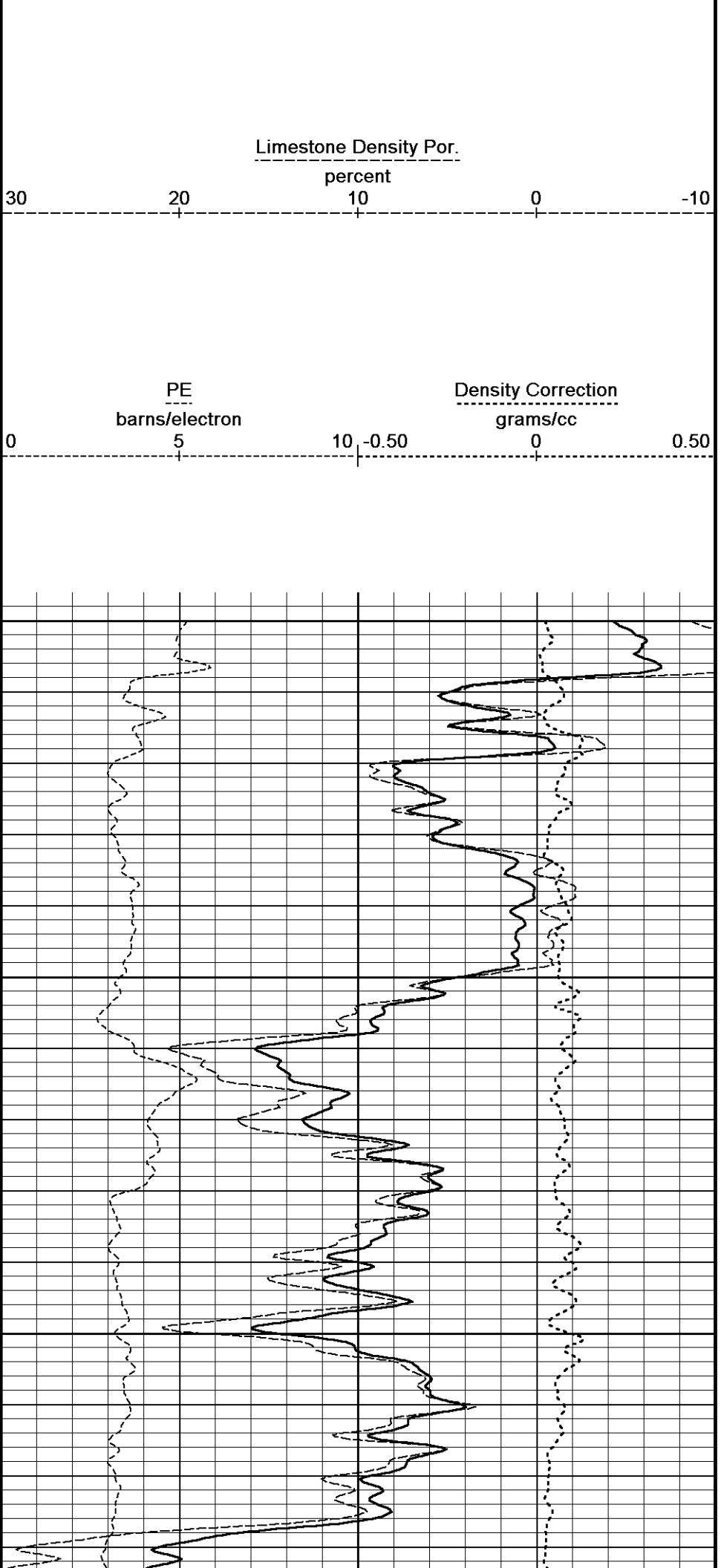
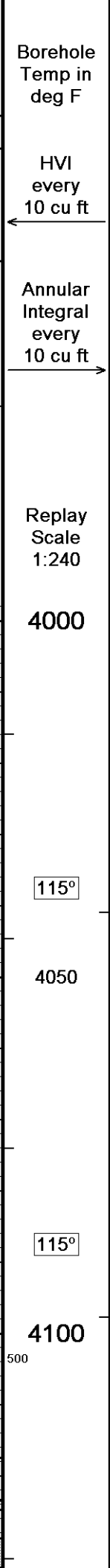
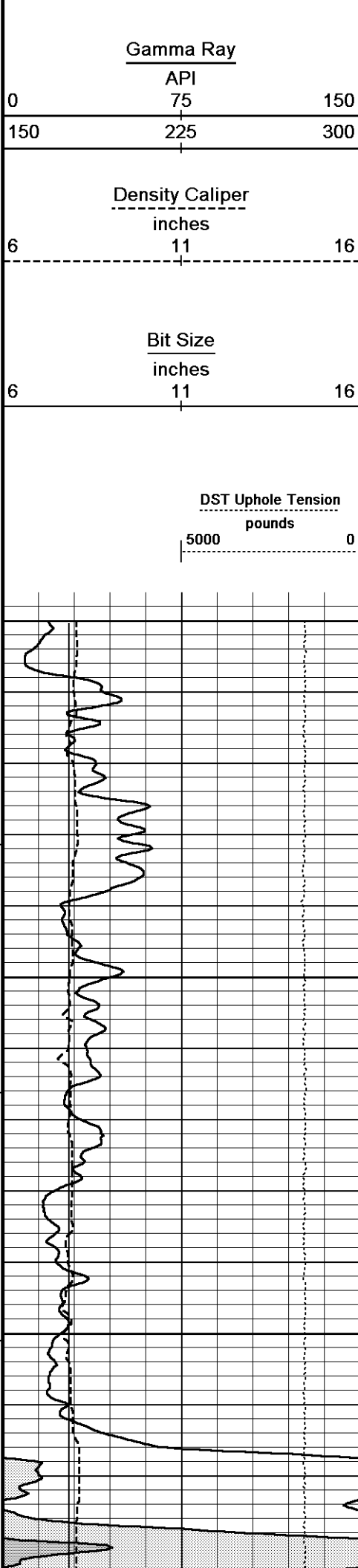


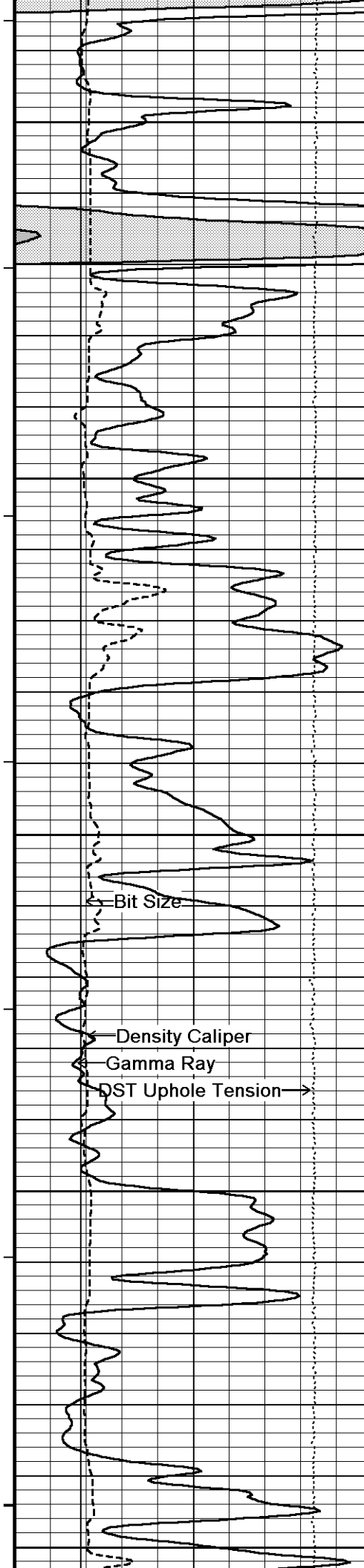
Depth Based Data - Maximum Sampling Increment 10.0cm	Plotted on 26-AUG-2013 12:04
Filename: C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer ...\Cimarex Hammer 19-5 Repeat.dta	Recorded on 26-AUG-2013 08:21
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583	

↑ REPEAT SECTION ↑

↓	5 INCH MAIN	↓
Depth Based Data - Maximum Sampling Increment 10.0cm	Plotted on 26-AUG-2013 12:04	
Filename: C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #1...\Cimarex Hammer 19-5 Main.dta	Recorded on 26-AUG-2013 09:54	
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583		







115°

4150

116°

4200

116°

4250

Bit Size

Density Caliper

Gamma Ray

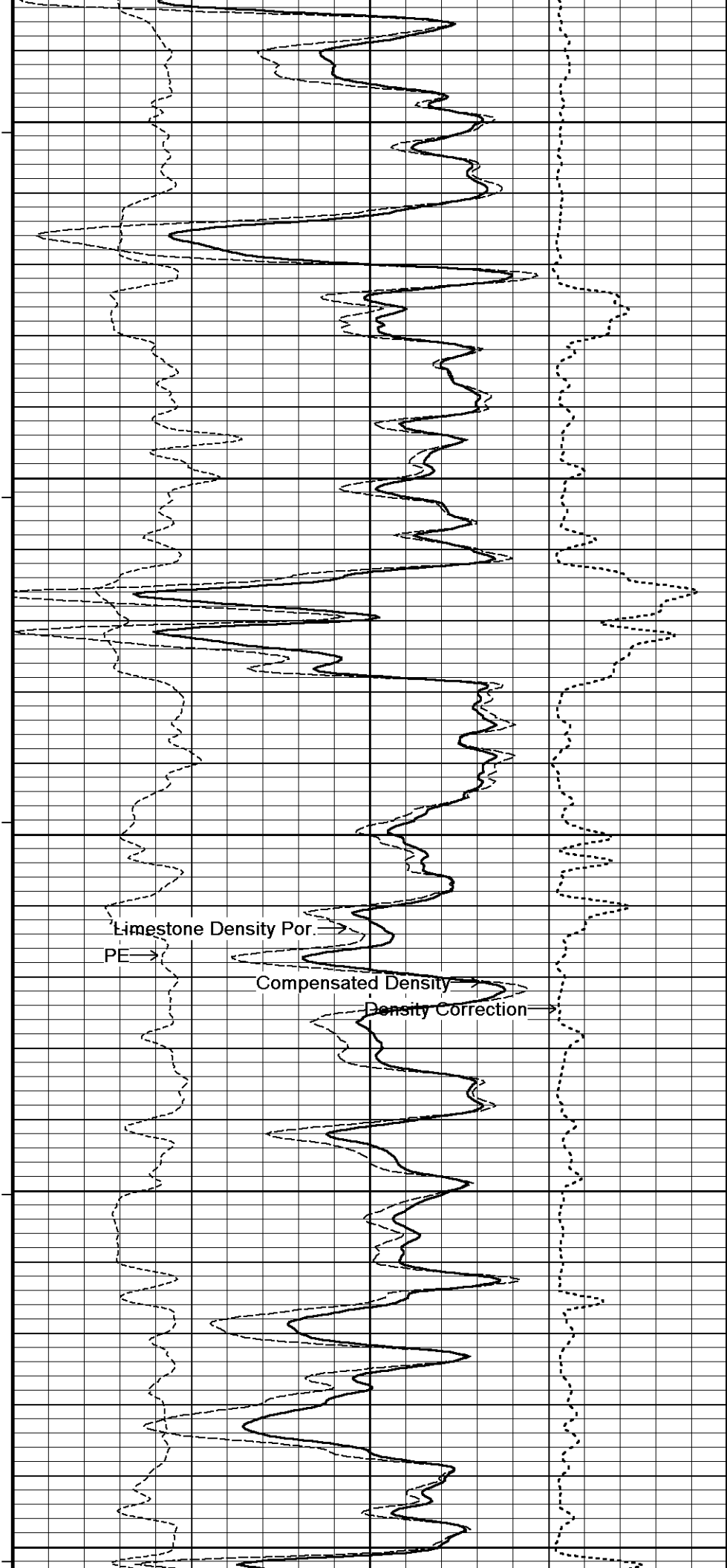
DST Uphole Tension

117°

4300

117°

4350

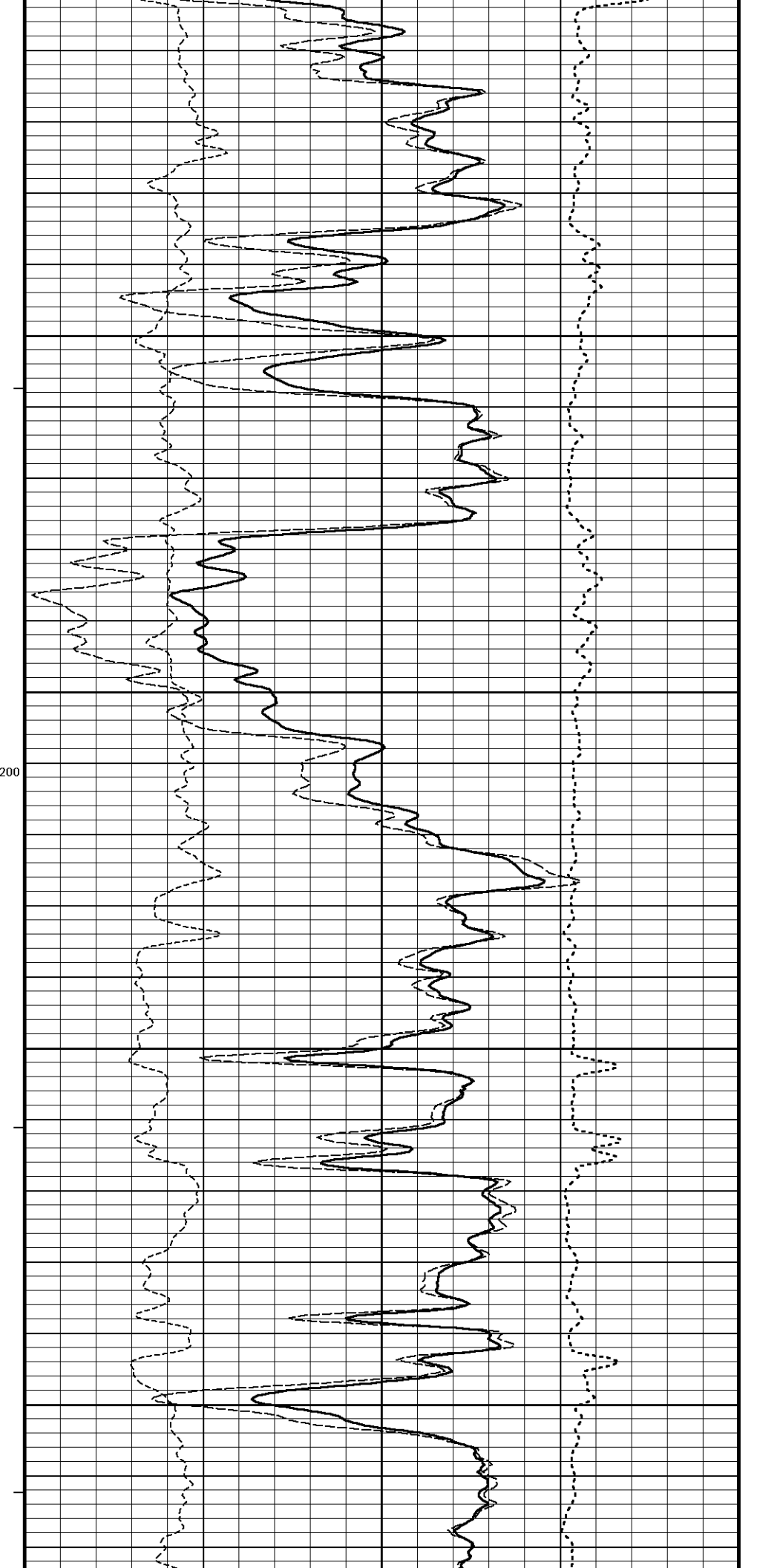
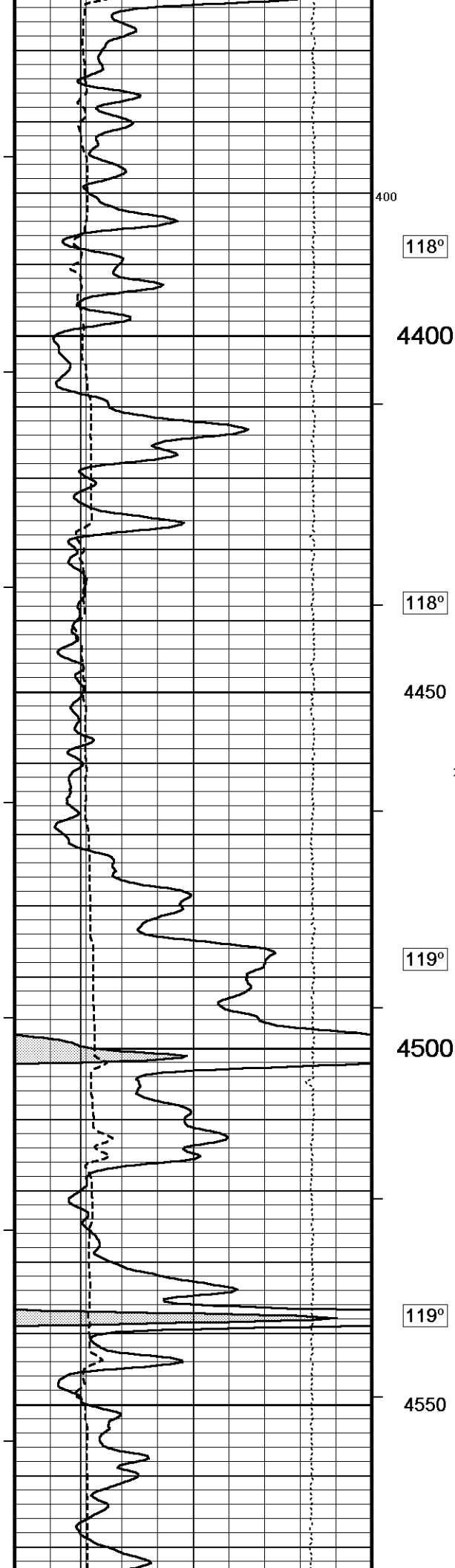


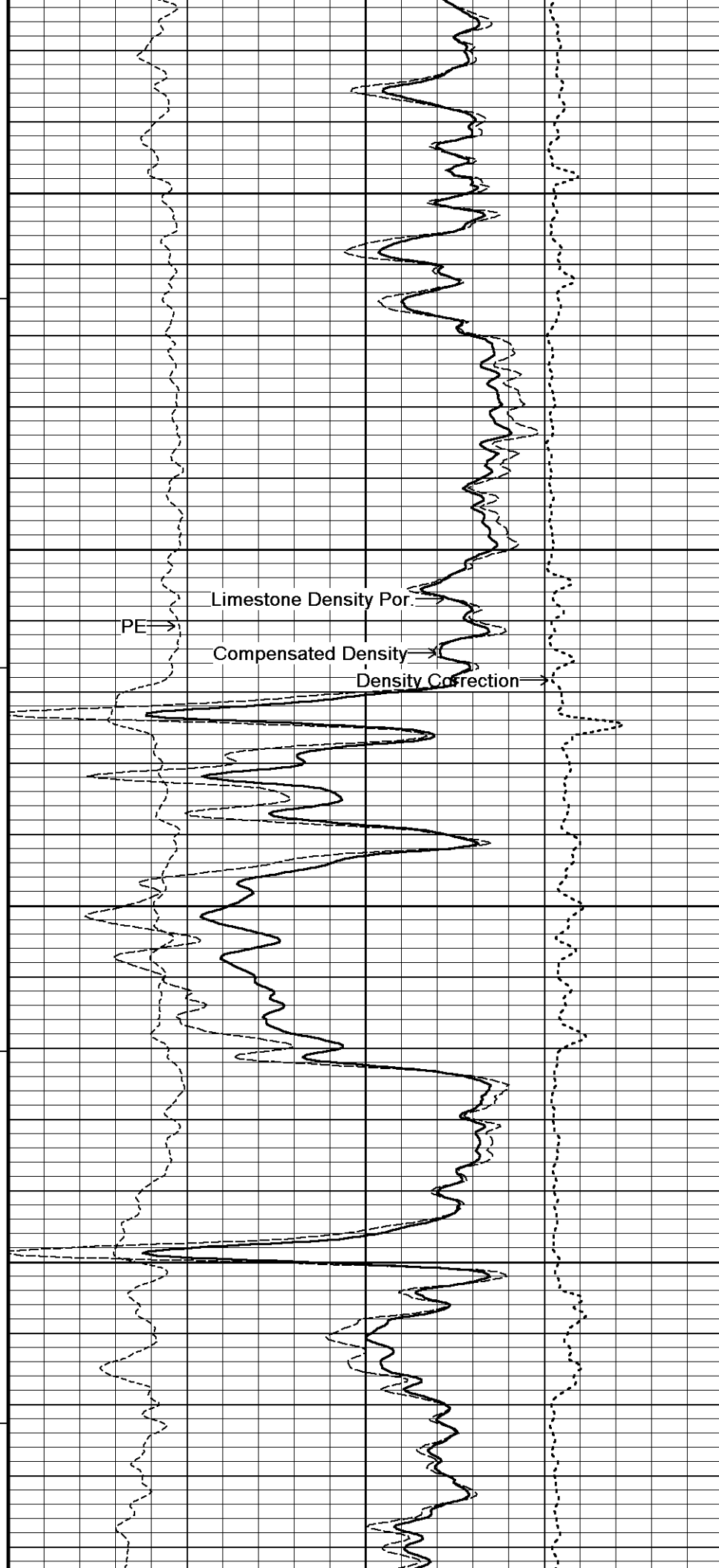
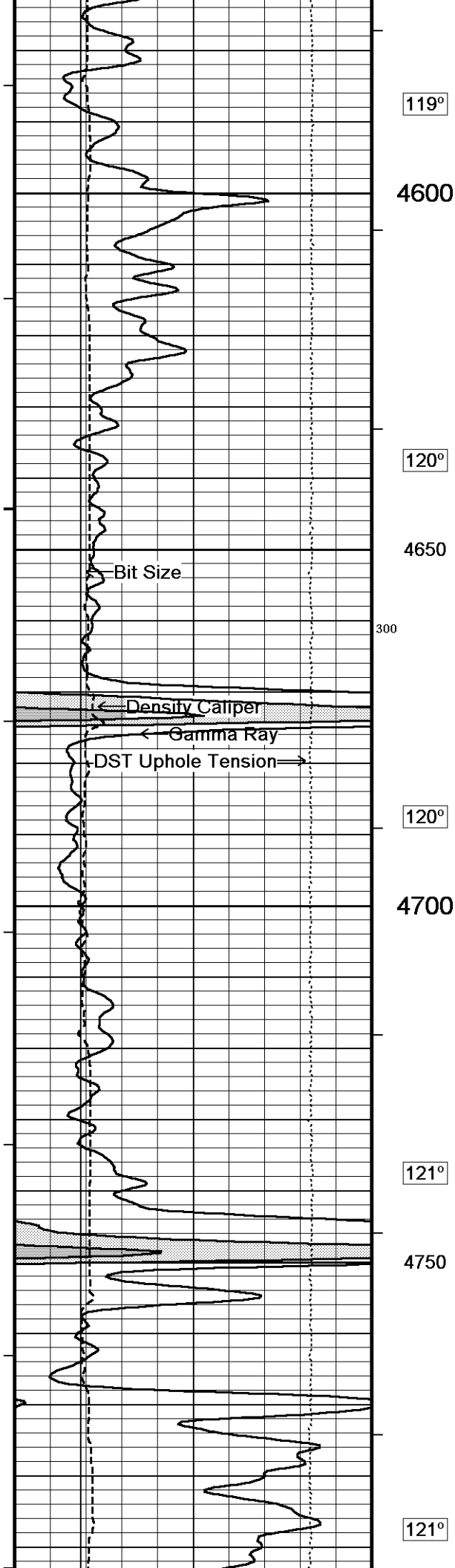
Limestone Density Por.

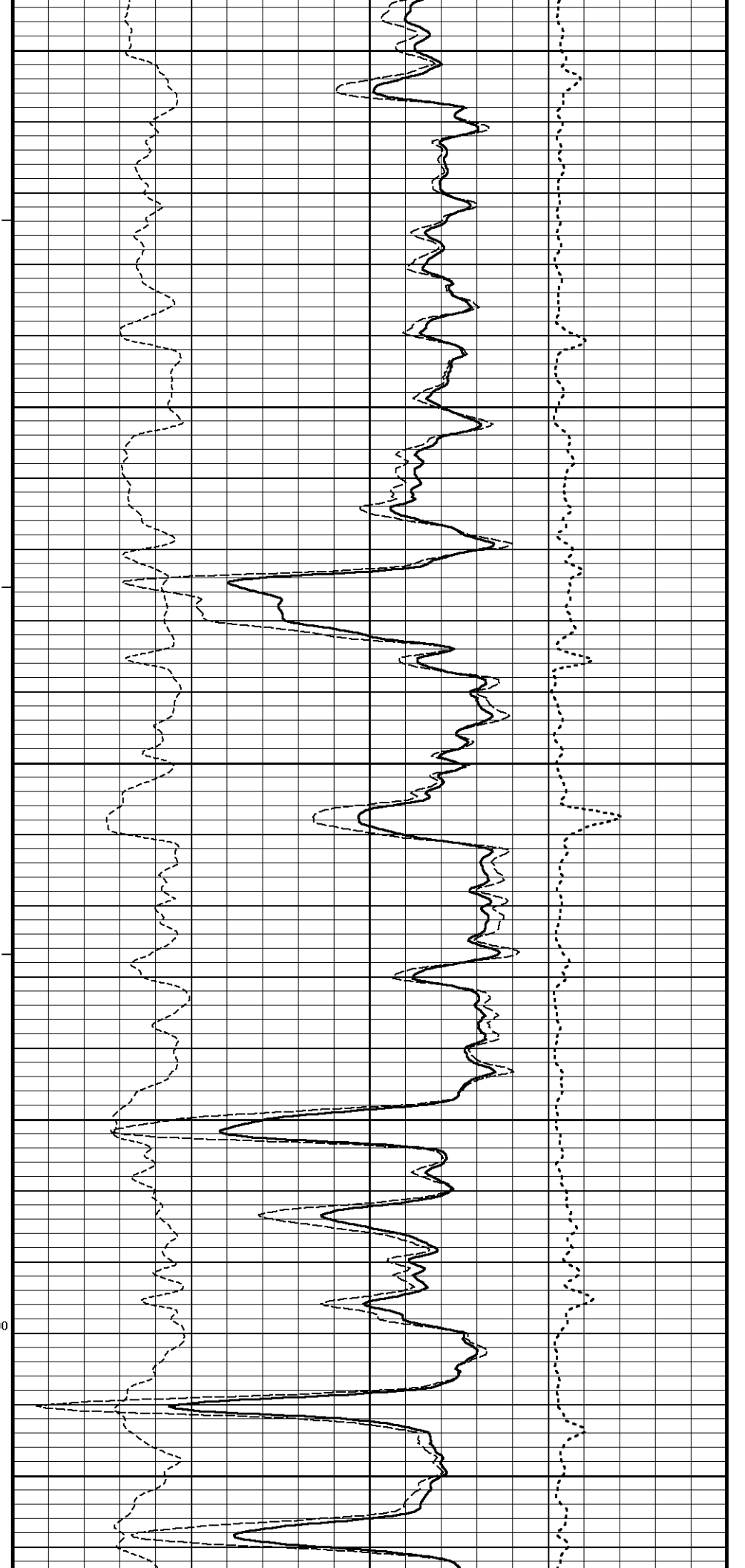
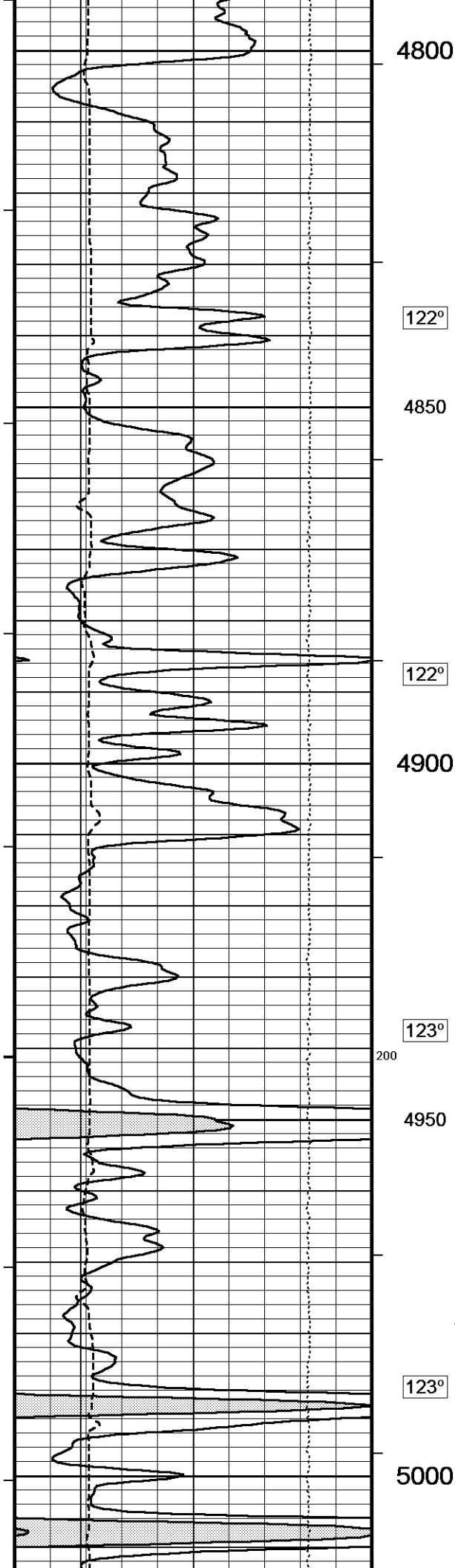
PE

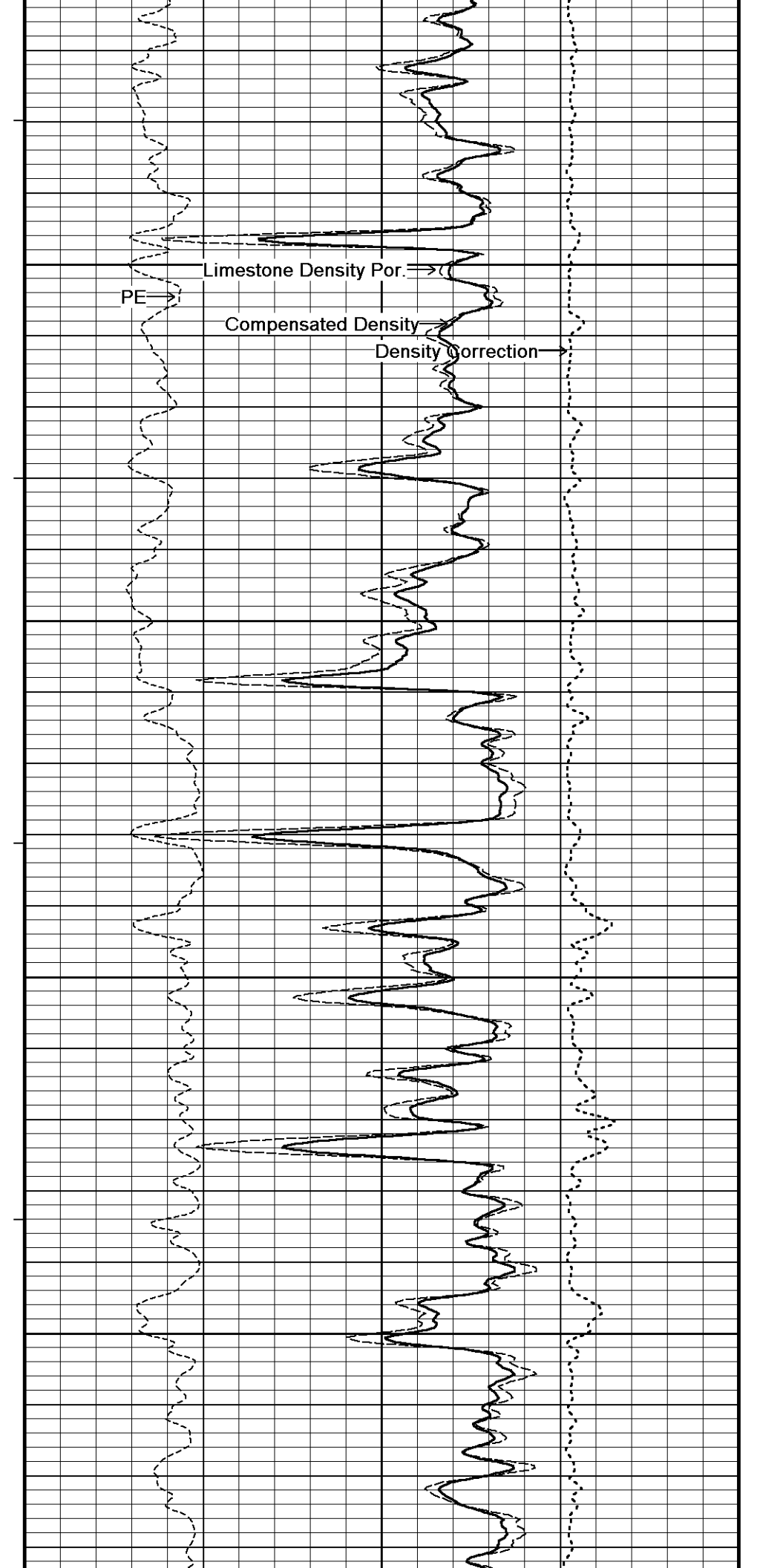
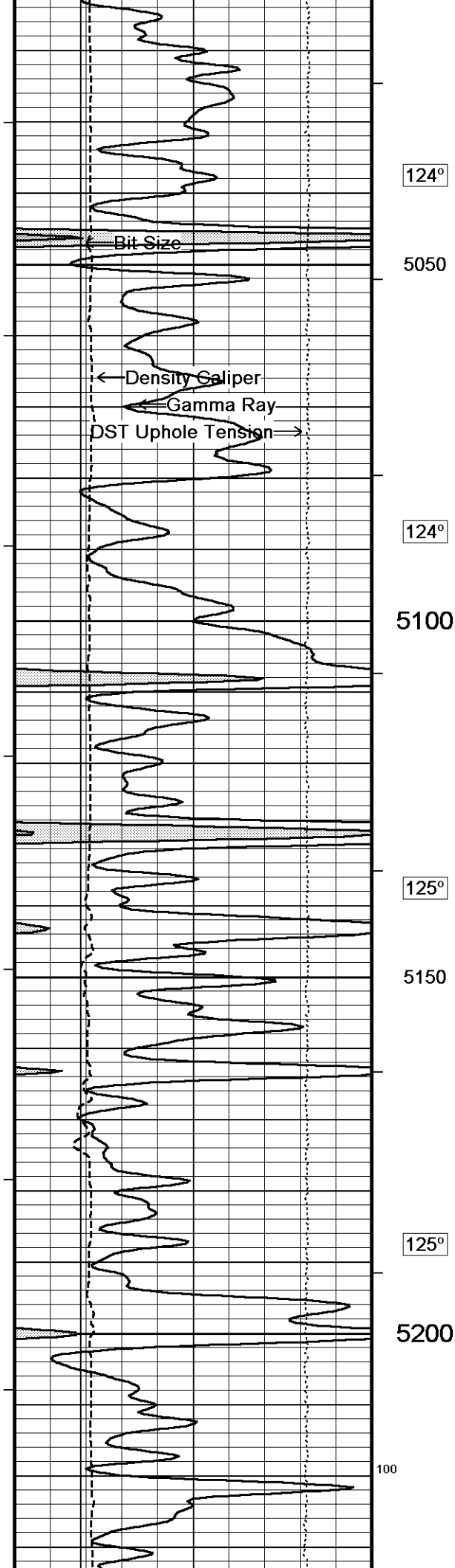
Compensated Density

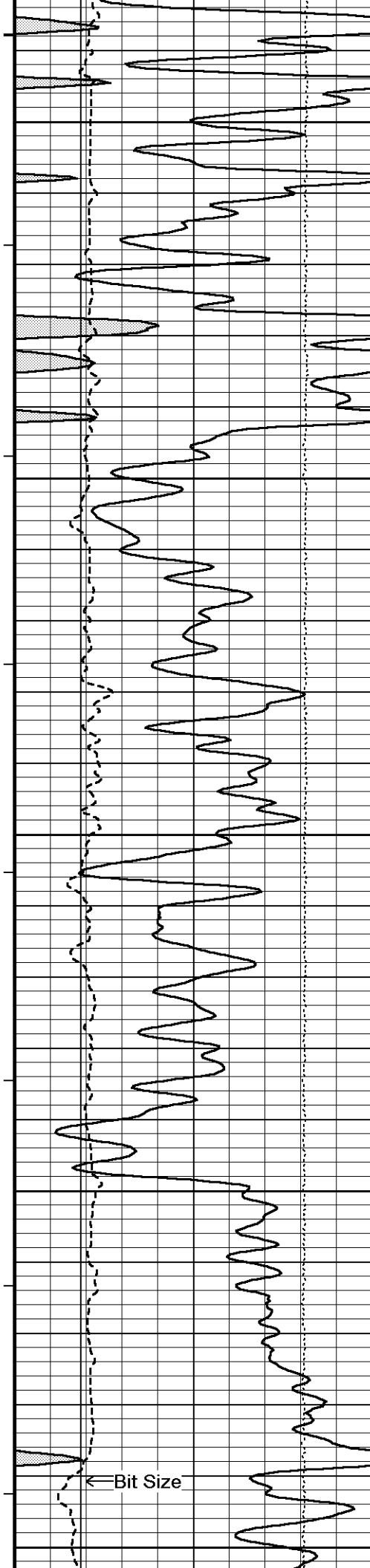
Density Correction











126°

5250

127°

5300

127°

5350

128°

5400

128°

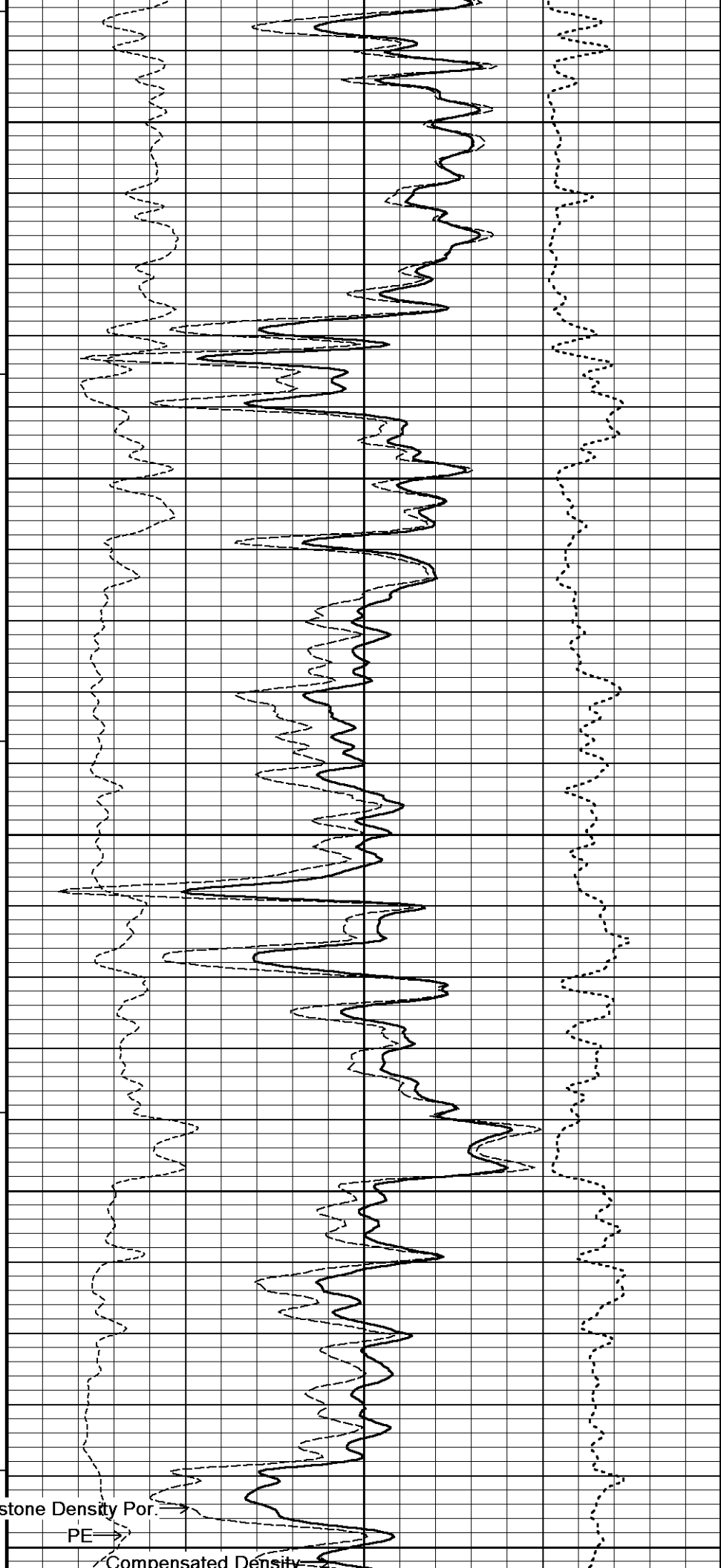
5450

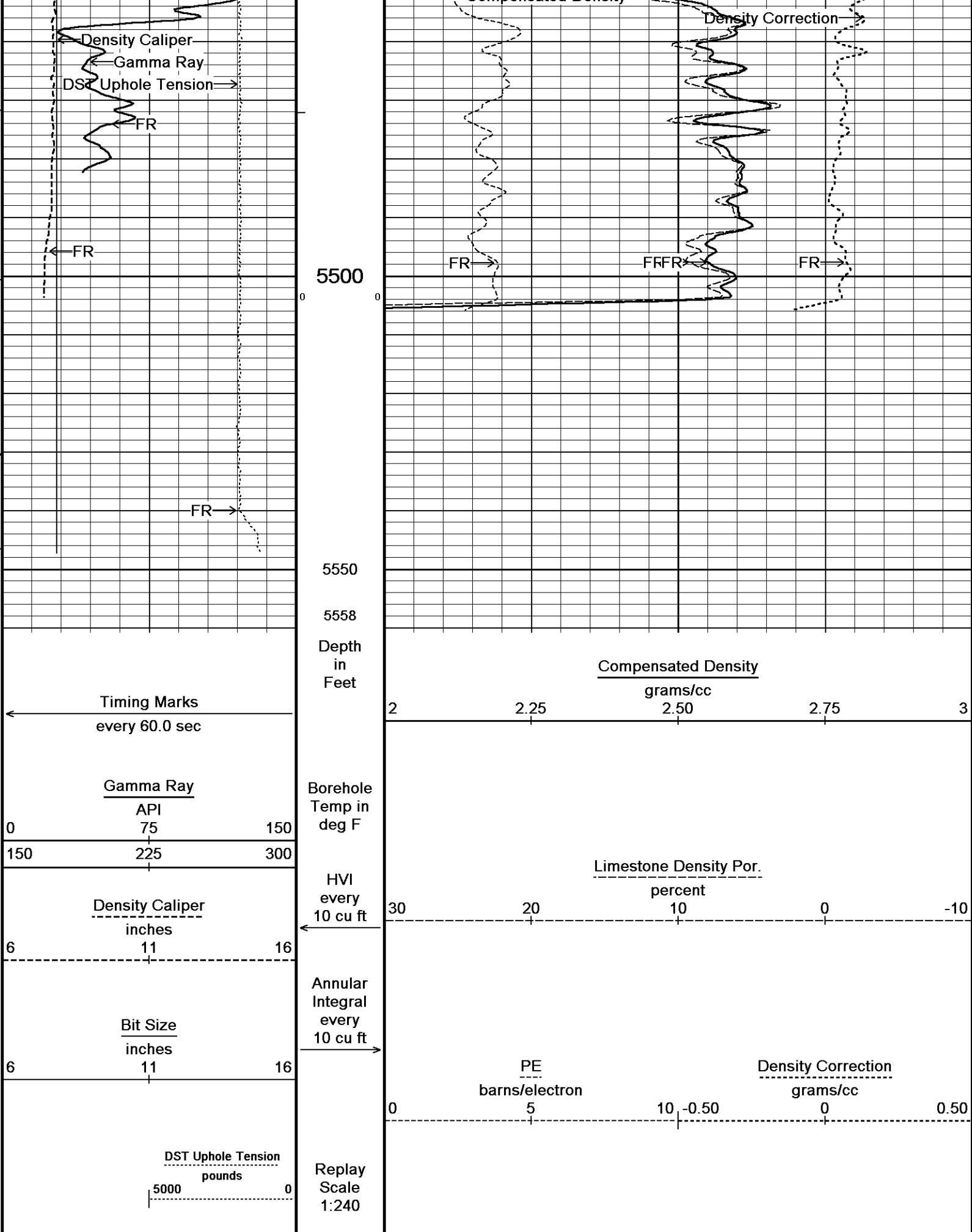
← Bit Size

Limestone Density Por. →

PE →

Compensated Density





Depth Based Data - Maximum Sampling Increment 10.0cm

Filename: C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #1...\Cimarex Hammer 19-5 Main.dta

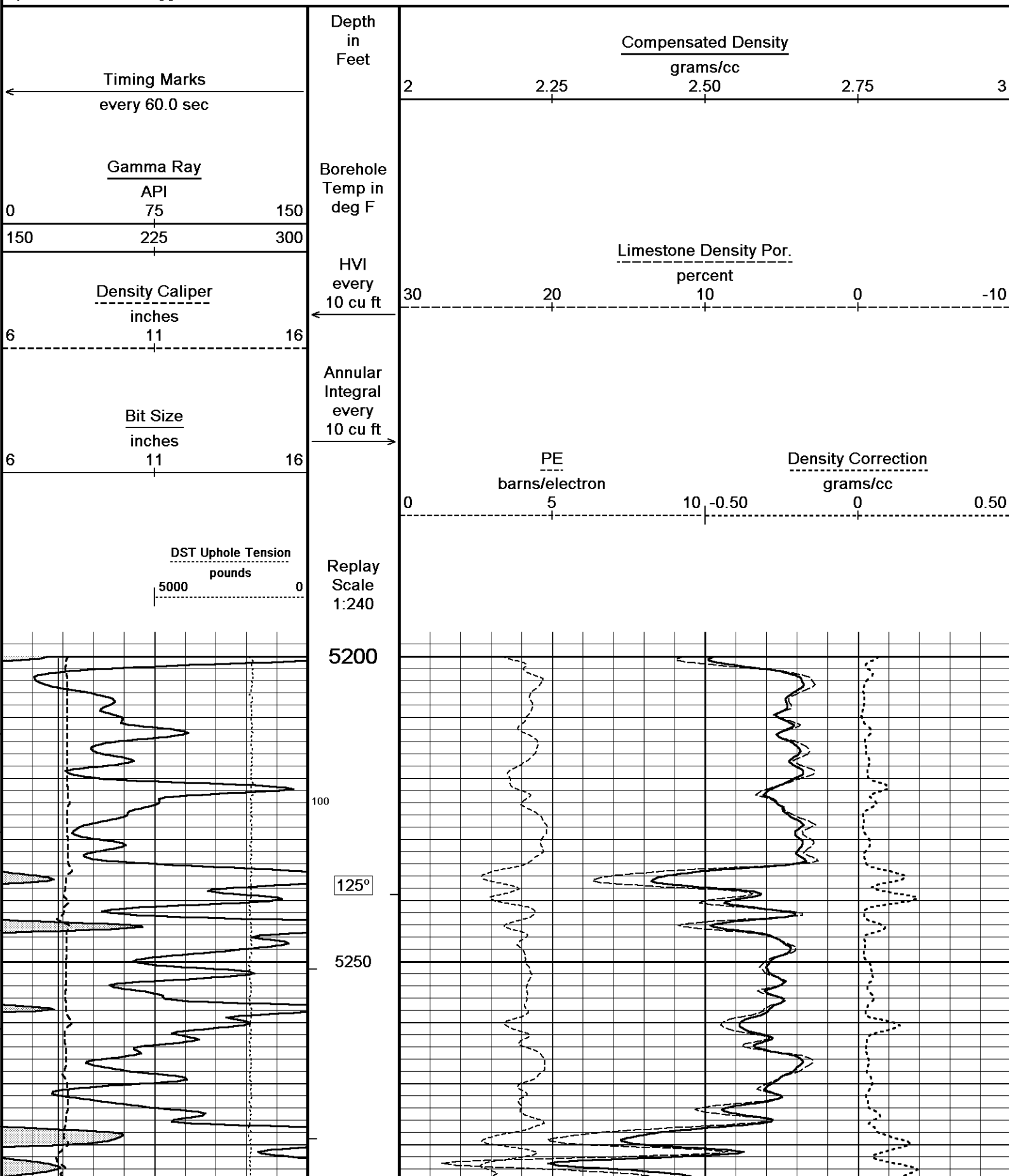
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583

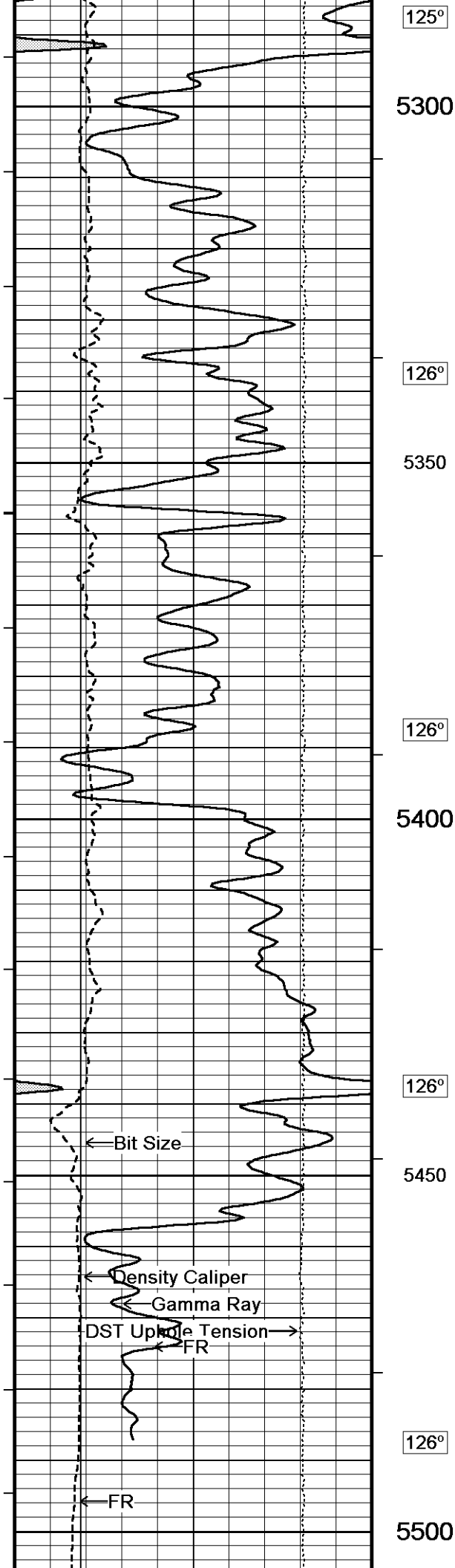
Plotted on 26-AUG-2013 12:04

Recorded on 26-AUG-2013 09:54

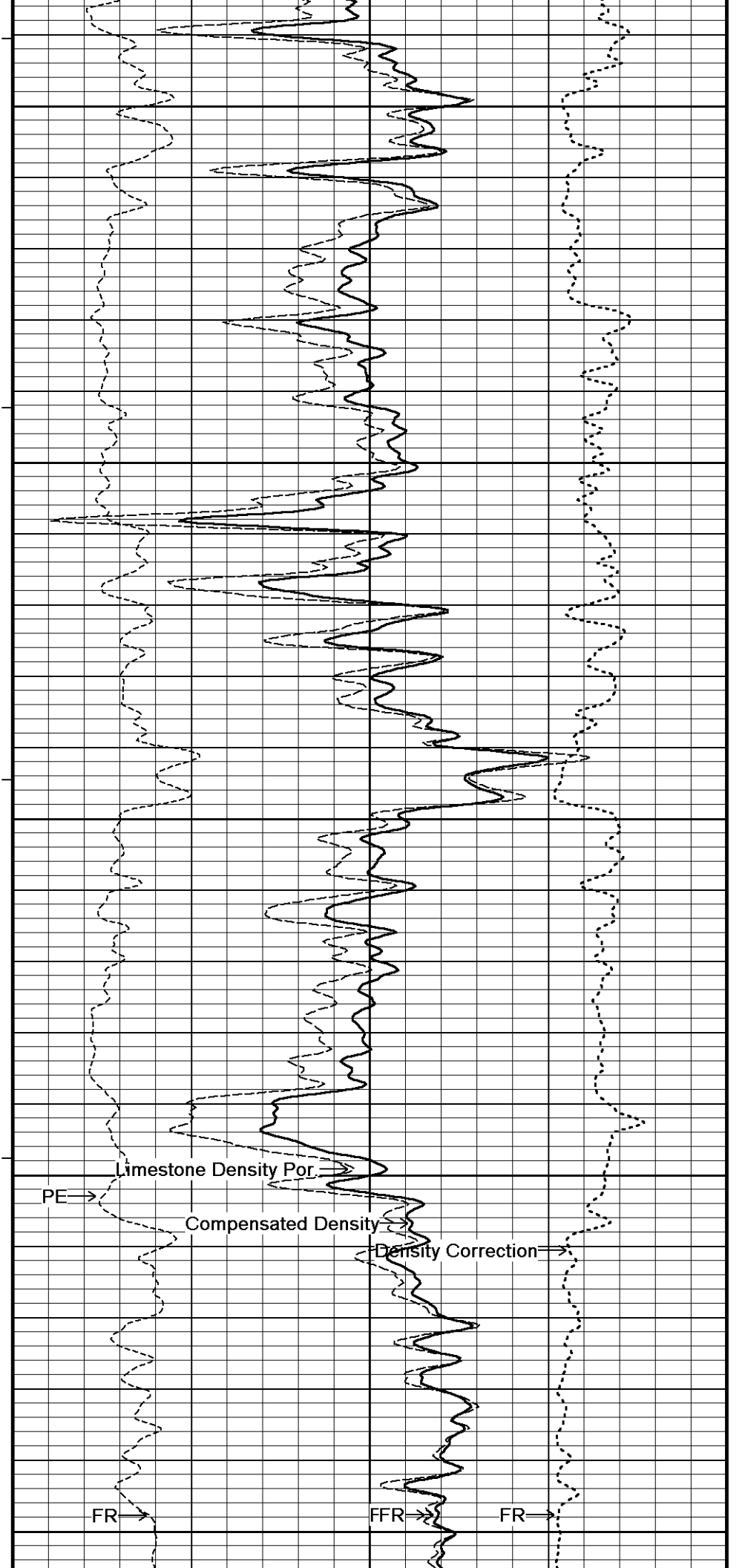
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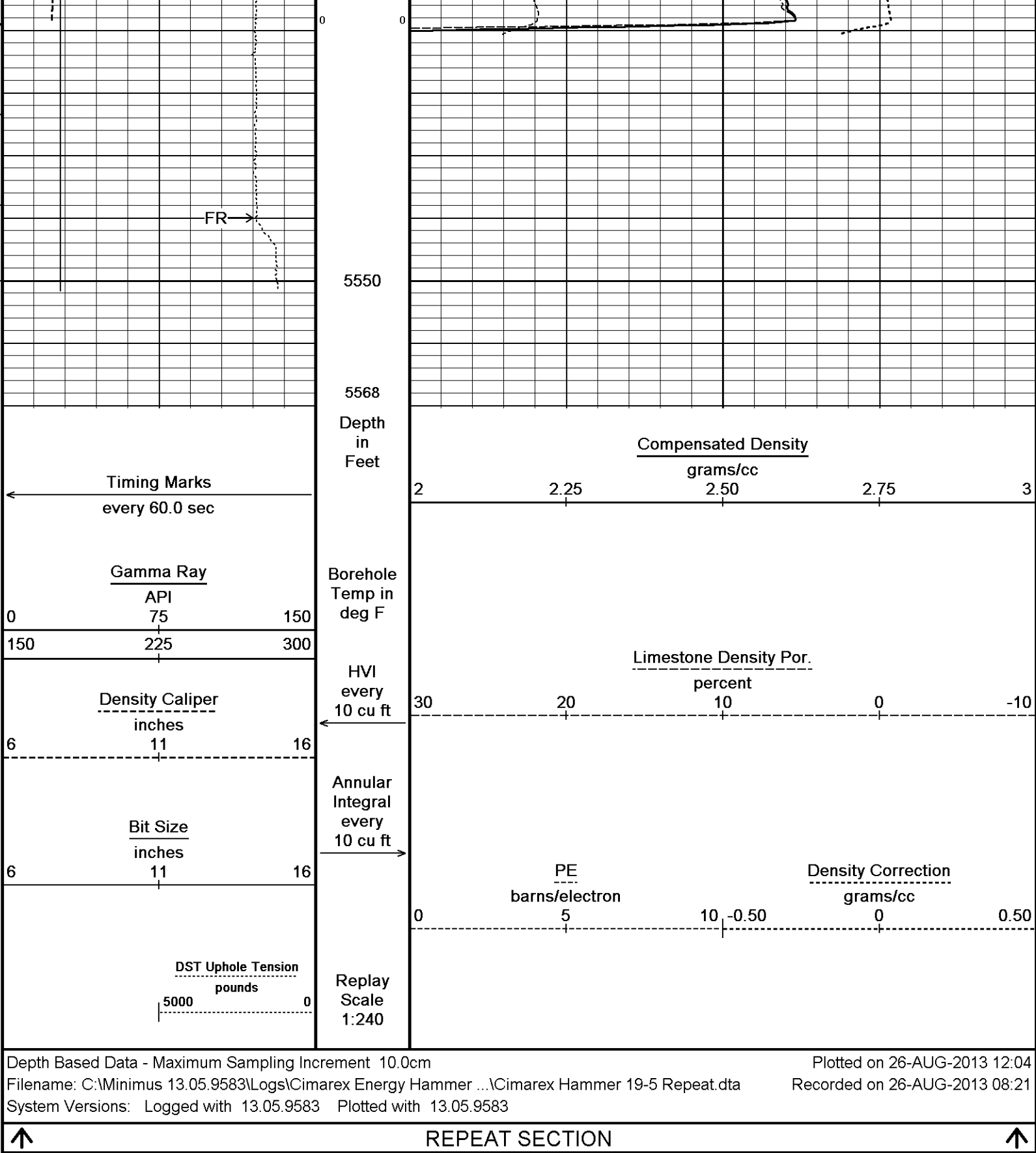
System Versions: Logged with 13.05.9583 Plotted with 13.05.9583





125°
5300
126°
5350
126°
5400
126°
5450
126°
5500





BEFORE SURVEY CALIBRATION		
C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #19-5\Cimarex Hammer 19-5 Main.dta		
General Constants All 000		Last Edited on 26-AUG-2013,06:03
General Parameters		
Mud Resistivity	1.120	ohm-metres
Mud Resistivity Temperature	62.000	degrees F
Water Level	0.000	feet
End of File		

Borehole Fluid Processing

Wet Hole

Hole/Annular Volume and Differential Caliper Parameters
 HVOL Method Single Caliper
 HVOL Caliper 1 Density Caliper
 HVOL Caliper 2 N/A
 Annular Volume Diameter 5.500 inches
 Caliper for Differential Caliper Density Caliper

Rwa Parameters

Porosity used Base Density Porosity
 Resistivity used Array Ind. Four Res Rt
 RWA Constant A 0.610
 RWA Constant M 2.150
 SW/APOR Tool Source 0.000

Gamma Calibration MCG-D.K 443

Field Calibration on 25-AUG-2013 20:40

	Measured	Calibrated (API)
Background	67	46
Calibrator (Gross)	1131	771
Calibrator (Net)	1064	725

Gamma Constants MCG-D.K 443

Last Edited on 26-AUG-2013,06:03

Gamma Calibrator Number GRC38
 Mud Density 1.12 gm/cc
 Caliper Source for Processing Density Caliper
 Tool Position Eccentred
 Concentration of KCl kppm
 K Mud Type Chloride
 K Mud Concentration 0.00 %

SP Calibration MCG-D.K 443

Field Calibration on 23-AUG-2013,11:54

	Measured	Calibrated (mV)
Reference 1	100.1	100.0
Reference 2	-100.5	-100.0

High Resolution Temperature Calibration MCG-D.K 443

Field Calibration on 23-AUG-2013,11:53

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

High Resolution Temperature Constants MCG-D.K 443

Last Edited on 23-AUG-2013,11:59

Pre-filter Length 11

Caliper Calibration MML-A 16

 Base Calibration on 16-AUG-2013 09:13
 Field Calibration on 25-AUG-2013 20:46

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	13832	5.98
2	16950	7.97
3	20199	9.86
4	24116	11.92
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
5.96	5.98

Micro Normal and Micro Inverse Calibration MML-A 16

 Base Calibration on 16-AUG-2013 09:25
 Field Check on 25-AUG-2013 20:45

Base Calibration

Channel	Measured		Calibrated (ohm-m)	
	Resistor 1	Resistor 2	Resistor 1	Resistor 2
Micro Normal	12.2	60.2	5.0	25.0
Micro Inverse	15.6	78.3	5.0	25.0

Field Check

Channel	Base Check (ohm-m)	Field Check (ohm-m)
Micro Normal	62.9	62.9

Micro Normal	02.9	02.9
Micro Inverse	48.3	48.3
Micro Normal and Micro Inverse Constants MML-A 16		Last Edited on 25-AUG-2013,20:40
Pad Type	8-12 in Soft Rubber Inflatable 006-9011-159	
Micro Normal K Factor	1.0000	
Micro Inverse K Factor	1.0000	
Standoff Offset	N/A	inches
Neutron Calibration MDN-B.J 387		Base Calibration on 16-AUG-2013 14:44 Field Check on 23-AUG-2013 10:33
Base Calibration		
	Measured	Calibrated (cps)
	Near Far	Near Far
	3010 92	3714 110
Ratio	32.584	33.764
Field Calibrator at Base		
	Calibrated (cps)	
	1653	2429
Ratio	0.681	
Field Check		
	Calibrated (cps)	
	1653	2452
Ratio	0.674	
Neutron Constants MDN-B.J 387		Last Edited on 23-AUG-2013,10:30
Neutron Source Id	P58125B	
Neutron Jig Number	5824NE	
Epithermal Neutron	No	
Caliper Source for Processing	Bit Size	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	None	
Formation Pressure	N/A	kpsi
Temperature Source	Constant Value	
Temperature	68.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	None	
Formation Fluid Salinity	N/A	kppm
Barite Mud Correction	Not Applied	
FE Calibration MFE-A.A 55		Base Calibration on 16-AUG-2013 08:59 Field Check on 23-AUG-2013 10:20
Base Calibration		
	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	950.9	126.8
Base Check	281.6	
Field Check	281.8	
FE Constants MFE-A.A 55		Last Edited on 26-AUG-2013,06:02
Running Mode	No Sleeve	
MFE K Factor	0.1268	
Caliper Source for FE correction	Density Caliper	
Caliper Value for FE correction	N/A	inches
Rm Source for FE correction	Constant Value	
Temp. for Rm Corr.	N/A	
Stand-off	Centred	inches
Induction Calibration MAI-A.A 178		Base Calibration on 29-APR-2013,09:40 Field Check on 23-AUG-2013 10:19
Base Calibration		
Test Loop Calibration		
Channel	Measured	Calibrated (mmho/m)
	Low High	Low High

1	17.6	484.7	9.3	966.2
2	6.2	391.4	7.6	821.4
3	4.0	264.5	5.2	566.0
4	2.3	135.1	2.6	279.2

Array Temperature 77.0 Deg F

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1	0.0	0.0	12.8	3763.3
2	0.0	0.0	29.8	3467.3
3	0.0	0.0	27.3	3014.2
4	0.0	0.0	18.8	2065.0
Deep			15.9	1995.4
Medium			40.3	3955.4
Shallow			45.7	5082.3

Array Temperature 0.0 79.8 Deg F

Induction Constants MAI-A.A 178

Last Edited on 26-AUG-2013,06:02

Induction Model		RtAP-WBM	
Caliper for Borehole Corr.		MML Caliper	
Hole Size for Borehole Correction		N/A	inches
Tool Centred		No	
Stand-off Type		Fins	
Stand-off		0.50	inches
Number of Fins on Stand-off		8.0000	
Stand-off Fin Angle		45.00	degrees
Stand-off Fin Width		0.5000	inches
Borehole Corr. Rm Source		Temperature Corr	
Temp. for Rm Corr.		MCG External Temperature	
Squasher Start		0.0020	mhos/metre
Squasher Offset		N/A	mhos/metre
Borehole Normalisation			
DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000
Calibration Site Corrections			
Channel 1		0.00	mmhos/metre
Channel 2		0.00	mmhos/metre
Channel 3		0.00	mmhos/metre
Channel 4		0.00	mmhos/metre
Apparent Porosity and Water Saturation Constants			
Archie Constant (A)		1.00	
Cementation Exponent (M)		2.00	
Saturation Exponent (N)		2.00	
Saturation of Water for Apor		100.00	percent
Resistivity of Water for Apor and Sw		0.05	ohm-m
Resistivity of Mud Filtrate for Sw		0.00	ohm-m
Source for Rt		0.00	
Source for Rxo		0.00	

High Resolution Temperature Calibration MAI-A.A 178

Field Calibration on 30-APR-2013,11:24

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

High Resolution Temperature Constants MAI-A.A 178

Last Edited on 30-MAY-2013,19:58

Pre-filter Length 11

Accelerometer Parameters MIE-B.A 254

Date Of Last Accelerometer Calibration 28-JUN-2012,12:18

	X Accelerometer	Y Accelerometer	Z Accelerometer
Slope	-1.098933	-1.108676	-1.107830
Offset	0.004383	0.002543	0.005594

Accelerometer Constants MIE-B.A 254		Last Edited on 07-MAY-2013,13:52			
Accelerometer Calibrator Number		000			
Accelerometer Temperature Characterisation					
X Accelerometer					
Serial Number		1135			
Calibration Date		10-May-2012			
	B0	B1	B2	B3	
Bias(g)	0.00000e+000	3.80136e-005	-1.44052e-008	1.07611e-010	
	SF0	SF1	SF2	SF3	
Scale Factor(mA/g)	3.00000e+000	2.76201e-004	2.79882e-007	1.31941e-009	
Y Accelerometer					
Serial Number		1137			
Calibration Date		10-May-2012			
	B0	B1	B2	B3	
Bias(g)	0.00000e+000	5.58386e-005	9.83739e-009	-1.99670e-011	
	SF0	SF1	SF2	SF3	
Scale Factor(mA/g)	3.00000e+000	2.77779e-004	1.92151e-007	1.16282e-009	
Z Accelerometer					
Serial Number		1096			
Calibration Date		29-Jun-2011			
	B0	B1	B2	B3	
Bias(g)	0.00000e+000	1.18445e-005	-1.40013e-009	1.45484e-010	
	SF0	SF1	SF2	SF3	
Scale Factor(mA/g)	3.00000e+000	2.85296e-004	2.19938e-007	1.07369e-009	

Caliper Calibration MIE-B.A 254			Base Calibration on 28-JUN-2013 11:46 Field Calibration on 25-AUG-2013 20:33		
Base Calibration					
Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)		
1	25947	25206	5.98		
2	35996	35798	7.97		
3	45695	45741	9.86		
4	57194	57363	11.92		
5	0	0	0.00		
Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	25173	25605	25407	25834	5.98
2	33891	34086	34350	34577	7.97
3	42019	42297	42807	42696	9.86
4	51555	52094	52685	52573	11.92
5	0	0	0	0	0.00
Field Calibration					
	Measured	Measured	Actual		
	Pads 1-5 Caliper(in)	Pads 3-7 Caliper(in)	Caliper(in)		
	5.92	6.04	5.98		
	Measured	Measured	Measured	Measured	Actual
	Pad 2 Caliper(in)	Pad 4 Caliper(in)	Pad 6 Caliper(in)	Pad 8 Caliper(in)	Caliper(in)
	3.06	2.99	2.95	2.99	5.98

Caliper Constants MIE-B.A 254		Last Edited on 01-MAY-2013,17:06		
Caliper Difference for BRKT		0.120	inches	

Magnetometer Parameters MIE-B.A 254			
Date Of Last Magnetometer Calibration		20-FEB-2013,16:25	
	X Magnetometer	Y Magnetometer	Z Magnetometer
Slope	-1.000000	-1.000126	-0.998001
Offset	-0.000662	-0.013917	0.004180

Magnetometer Constants MIE-B.A 254		Last Edited on		
Magnetometer Calibrator Number		000		

Magnetic Declination	6.12	degrees	East
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Imager Pad Check MIE-B.A 254

Field Check on

Pad 1	Pad Not Tested	Pad 5	Pad Not Tested
Pad 2	Pad Not Tested	Pad 6	Pad Not Tested
Pad 3	Pad Not Tested	Pad 7	Pad Not Tested
Pad 4	Pad Not Tested	Pad 8	Pad Not Tested

Compact Micro Imager Constants MIE-B.A 254

Last Edited on 25-AUG-2013,20:32

Sonde Configuration	Imager Mode	
Arm-Pad Kit	Normal Pads (12.25 in)	
Arm-Pad Kit Serial Number	N/A	
Centre Pad 1 Rotational Offset	0.00	degrees
Image/Borehole Ovality Reference	Azimuth of Pad 1	
Non Active Buttons	Omit	
Search Angle	0.00	degrees
Correlation Interval	3.28	feet
Correlation Step	1.64	feet
Current Offset	0.0000	mAmp
Squasher Start	0.0500	mAmp
Image Processing	Enabled	

Photo Density Calibration MPD-B 59

Base Calibration on 23-AUG-2013 11:44

Field Check on 23-AUG-2013 11:53

Density Calibration					
Base Calibration			Measured	Calibrated (sdu)	
		Near	Far	Near	Far
Reference 1		58612	28481	59556	30836
Reference 2		23605	2511	24941	2541
Field Check at Base					
		1186.0	1254.6		
Field Check					
		1184.3	1253.5		
PE Calibration					
Base Calibration			Measured	Calibrated	
	WS	WH	Ratio	Ratio	
Background	217	1063			
Reference 1	21648	58418	0.374	0.371	
Reference 2	6282	23469	0.271	0.272	
Field Check at Base					
	216.6	1062.7			
Field Check					
	213.2	1058.6			

Density Constants MPD-B 59

Last Edited on 26-AUG-2013,06:03

Density Source Id	P50557B
Nylon Calibrator Number	DNCE695
Aluminium Calibrator Number	DACD698
Density Shoe Profile	8 inch
Caliper Source for Processing	Density Caliper
PE Correction to Density	Not Applied
Mud Density	1.12 gm/cc
Mud Density Z/A Multiplier	1.11
Mud Filtrate Density	1.00 gm/cc
Dry Hole Mud Filtrate Density	1.00 gm/cc
DNCT	0.00 gm/cc
CRCT	0.00 gm/cc
Density Z/A Correction	Hybrid
Matrix density (gm/cc)	Depth (m)
2.71	0.00
0.00	0.00

0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00

Caliper Calibration MPD-B 59

Base Calibration on 23-AUG-2013 11:17

Field Calibration on 23-AUG-2013 11:19

Base Calibration

Reading No

Measured

Calibrator Size (in)

1	16284	3.99
2	23984	5.98
3	31584	7.97
4	39888	9.86
5	49152	11.92
6	N/A	N/A

Field Calibration

Measured Caliper (in)

Actual Caliper (in)

5.91	5.98
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Down-hole Tension Calibration SMS 0

Field Calibration on 26-AUG-2013 07:17

Reading No

Measured

Calibrated (lbs)

1	15380.34	0.00
2	16307.40	570.00

DOWNHOLE EQUIPMENT

C:\Minimus 13.05.9583\Logs\Cimarex Energy Hammer #19-5\Cimarex Hammer 19-5 Main.dta

3/8" Triple Cone Cable Head (MCB C A)

MCB-C.A 5 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

Compact Comms Gamma

MCG-D.K 443 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Micro-log

MML-A 16 LG: 7.97 ft WT: 81.6 lb OD: 2.24 in

Compact Neutron

MDN-B.J 387 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper

MPD-B 59 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

SKJ-D.A Compact Knuckle Joint

SKJ-D.A 36 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint

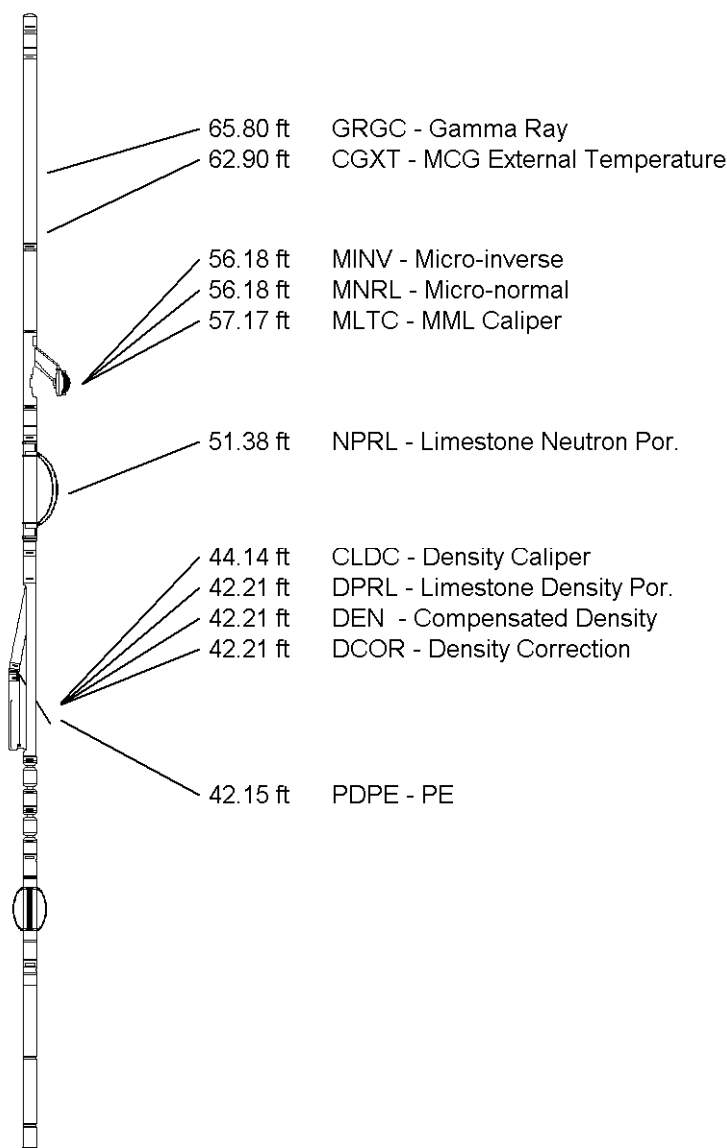
SKJ-D.A 37 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

Compact MMI Memory Section

MIM-A.A 119 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

Compact MMI Electrode Section

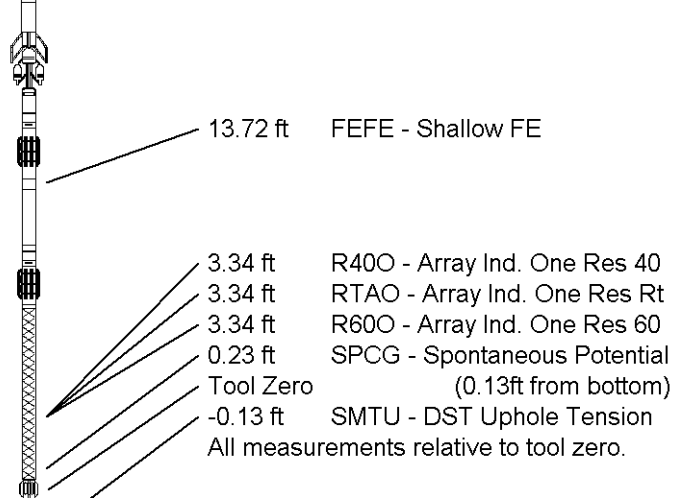
MIE-B.A 254 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in



Compact Focussed Electric
MFE-A.A 55 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction
MAI-A.A 178 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 72.67 ft Weight: 573.2 lb



COMPANY	CIMAREX ENERGY CO.
WELL	HAMMER 19-5
FIELD	LETTE SE
PROVINCE/COUNTY	HASKELL
COUNTRY/STATE	U.S.A. / KANSAS

Elevation Kelly Bushing	2857.00	feet	First Reading	5697.00	feet
Elevation Drill Floor	2855.00	feet	Depth Driller	5544.00	feet
Elevation Ground Level	2848.00	feet	Depth Logger	5540.00	feet



Weatherford®

COMPACT PHOTO DENSITY
COMPENSATED NEUTRON
MICRORESISTIVITY LOG